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With the esteem and
best wishes of The
Author

AN ESSAY

ON THE

TREATMENT

OF

COMPOUND AND COMPLICATED

FRACTURES,

BEING THE

ANNUAL ADDRESS

BEFORE THE

MASSACHUSETTS MEDICAL SOCIETY,

MAY 28, 1845.

BY WILLIAM J. WALKER, M. D.

FELLOW OF THE SOCIETY.

'Instruire les gens par Observations, c'est les instruire, pour ainsi dire, par figures, et par de vives peintures qui representent au naturel les maladies.' *Petit.*

'Those who are employed in recording cases on unquestionable facts, give us the true and only picture of diseases. They speak of none which they have not seen. But systematic authors, obliged to explain each disease in its order, give descriptions of diseases widely distant from truth, describing what manifestly they have not seen, and explaining, without the slightest remission of their wonted confidence, what they have not learned and cannot know.' *John Bell, Principles of Surgery, Vol.* III. *page* 99 *Quarto Ed*

'Per varios usus artem experientia fecit
Exemplo monstrante viam.' . . . *Manilius.*

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Mr. President, and Gentlemen

of the Massachusetts Medical Society,

I propose on the present occasion to offer you some observations on compound and complicated fractures of the bones; confining myself principally to some of the most important practical points of treatment; illustrating my views on this subject by cases which have occurred under my own observation; and placing at their side the reports of similar cases treated by distinguished surgeons of the present and past ages; I have

adopted this course, believing with a writer * of the last century, 'That a publication of real cases is, without doubt, the only way of determining what it is of so much importance to know in surgery, 'Quid natura faciat, aut ferat.'' I will likewise say, with the same distinguished writer, 'the present collection contains some remarkable instances of the surprising power of nature in the relief of injuries offered to her, such as theoretical reasoning would hardly allow us to hope for. They cannot therefore fail of being useful and agreeable to the followers of the healing art, if faithfully related; and I can assure the public, that it has been my aim to represent facts as they really were, not as they would tell the best.'

Aware that the value of detailed cases must depend upon the ability and accuracy with which they have been observed, as well as upon the fidelity with which they are reported, I have avoided bringing forward such cases as I might have found in journals and other ephemeral productions, and have confined my researches to the writings of men whose names are a sufficient guaranty of the truth and accuracy of their several memoirs.

Here, then, gentlemen, I place at your disposal several cases of compound and complicated fractures which have occurred under my own observation, numbered from one to six.† At the same

* Cases in Surgery, by Charles White, F. R. S.—*London*, 1776.

† See Cases annexed.

time, I present you with other somewhat similar cases, selected from the highest authorities, and numbered from seven to twenty-three, inclusive. These cases, as I think, prove the powers of nature in healing compound fractures, attended with great contusion, laceration, and loss of substance of the bones, and of the skin, and other soft parts, to be much greater than is generally supposed. They also show us that large portions of bone, when lost by accident, or removed by art, may be reproduced by the powers of nature: and they illustrate, in a striking manner, the truth and importance of certain practical precepts established by the older writers on surgery, with respect to the treatment of wounds, complicated with fractures of the bones. The precepts to which I allude are,

First, that all tendinous or membranous structures which obstruct the removal of foreign bodies, or unduly confine or strangulate the soft parts, when swollen by inflammation, should be promptly and freely divided.*

Second, that such dependent orifices should be preserved, or counter openings made, as will, when aided by position and dressings, secure the free

* But there are cases, as I have before said, in which a surgeon of resolution may preserve a limb, even where amputation may appear to be indicated. In such a case, besides attending to the general rules of treatment, he should never neglect making free dilatations of the membranous parts with deep incisions. By the use of such means, inflammatory swelling is dissipated and the cure rendered much more certain.—*Bordenhave, Mémoirs de L'Académie Royale de Chirurgie. Vol. 5.*

discharge of all fluids which might otherwise stagnate within the wound.*

Third, that portions of bone protruding through the integuments, which cannot, easily and without violence, be reduced to their proper place, should at once be removed by the saw: † and that all foreign bodies,‡ loose portions, or shivers of bone, should be promptly extracted from the wound.

Fourth, that great pain, inflammation, or nervous symptoms, depend rather on peculiar complication, than on the extent of the wound. And that they

* Un vrai chirurgien ne se contente pas de remédier aux accidens présens, il faut que son intelligence lui fasse appercevoir les événemens avant qu'ils arrivent. L'experience a appri qu' on pouvoit prévoir dés la premiére inspection, le besoin d'une countre ouverture, pour suppléer, dans l'intention sus dite, aux ouvertures de la plaie moins avantageusement situées. On ne doit rien négliger pour le succès dans un cas aussi grave.—Martinière. Memoires de L' Acad. vol. 2 and page 23.

† Antequam reponantur, considerandum est an os eminens in propriam cavitatem, beneficio debitae extensionis, citra violentiam, et convulsionis periculum, restitui possit, nec ne? Si potest citra periculum restitui, restituatur; sin minus, non restituatur. Periculosam restitutionem indicant proëminentia magna, inflammatio, et pars, ob musculorum contractionem, dura. Quod, si ergo restitui nequit, eminens nudum forcipe præcidendum, et postea, fractura, per modicam factam extensionem, coaptanda. Melius enim est membrum aliquantum brevius redderc, quam ossa non coaptata relinquere vel violenter extendere. Quorum utrumque argrotanti convulsionem et mortem afferret.—*I. Sculteti. Armamentarium Chirurj. Renovatum et auctum Amstelodami.* 1671, *Page* 21.

‡ Richard Wiseman says, 'cleanse the wound first from all strange bodies, as bullets, armour, apparel, and shivers of bone. So shall the cure succeed more happily.' In another place, he says, 'Therefore to prevent sinuosities, you are to enlarge the orifice at the first, and keep it so wide open, that the matter which is daily there ingendered may have free passage out.' Again, 'If you make not this dilatation in the beginning, you may afterwards, perhaps, be forced to do it, when the part is accompanied with great defluxion and pain, or when the bones are corrupt by retention of the matter: and what condition it will then be in to admit of incision, may be easily guessed by any one that hath common sense.' vol. 2, p. 178.

indicate great danger* unless rightly understood, appropriately treated and relieved.

As illustrative of the principles here advanced, I propose now to read to you a single case, selected from the second volume of Gooch's surgery, trusting that the other cases which I have selected and hereto annexed, as a basis of this essay, will repay you for the trouble of reading them at some leisure moment.

'July 11th, 1739, J. W. of B. about twelve years of age, had both the tibia and fibula, fractured, by the wheel of a wagon, heavily laden, passing obliquely over the limb in a deep rut, from just beneath the knee externally quite to the extremity of the heel, making the most horrid, large lacerated wound we ever saw, with about nine inches of the tibia projecting.

'At first sight we knew not how to act for the best in a case so dismally circumstanced; we de-

* Neither must you have lesse care of binding up and rolling the part, than of your medicines: For it doth not a little conduce to the cure, to binde it so fitly up as it may be without paine.—*Ambrose Paré. Translated out of Latin and compared with the French by F. W. Johnson. London. Anno* 1634, *Page* 424.

J'ai un grand soin d'empêcher que le blessé ne souffre aucune douleur en quelque lieu que ce soit de la jambe.—*Traité Complet de Chirurgie. Par M. G. de la Motte. 3me edition par M. Sabatier. Vol.* 2, *Page* 587.

The whole welfare of the patient depending upon the easy bandage and position of the member.—*Chirurgical Treatises by Richard Wiseman, Serjeant, Chirurgeon to King Charles, 2d. 5th Edition. Vol.* 2, *Page* 181. *London*, 1719.

Again. If it (the bandage) could not have been so put on, I should have forbourn the use of them, the cure of these wounds consisting in the easy dressing and quiet position, without which you will not cure one of them.—*Wiseman, Vol.* 2, *Page* 187.

liberated upon it, and at length resolved to saw off a considerable portion of the bone, [according to Fig. 1*; Pl. 16,] rather than instantly amputate the limb. We then snipped off the loose and tattered teguments, removed some sharp-pointed fragments of the bones, brought the parts into as good a state as we could, dressed in the common manner as lacerated wounds require, and placed the limb in a case of stiff paper, well lined with wool, tow, etc., and so contrived as to give as little disturbance to it as possible upon dressing; using the tailed bandage.

'*The wound soon digested kindly, and the cure was effected by the usual treatment, without any ill accident of consequence intervening, which favorable circumstance we ascribed to our precaution in removing the fragments and splinters of the bones, etc., at our first dressing.*

'In about three weeks, I was sensible, as were also several surgeons whom curiosity led to see so uncommon a case, that the substance which grew in the space of five inches, entirely void of bone, had acquired, in the middle only, a greater degree of solidity than flesh; which circumstance, not agreeing with the general received notion of the generation of callus, we proved, beyond dispute, with a sharp pointed instrument; and we observed

* As the plate merely represented the portion of tibia removed, five inches long, it was deemed unnecessary to copy it.

that the ossification was gradually formed from that central point, which was considerably advanced before any exfoliation was cast off the ends of the divided bones. In less than four months, the whole space was so well supplied with callus, or, rather, new bone, that he was able to raise his leg, when the bandage was off, without its bending. About a month after, he ventured, without my knowledge, to stand upon it, when he thought it had stability enough to bear an equal proportion of the weight of his body; and a little more than half a year after the accident, he walked pretty well, even without the assistance of a stick. *The leg is well shaped, not half an inch shorter than the other; and some years after the cure, he told me he could walk forty miles in a day without pain.*

'*In thirteen compound fractures, I have sawn off a considerable portion of the tibia, and succeeded in both old and young subjects.* This experience has given me fair opportunities of observing every day's progress in the generation of *callus;* and I always found it had the appearance, externally, of granulations of flesh, changing gradually into bone; concerning which wonderful operation of nature, I shall not attempt an explication, but this, the preceding, and following paragraphs, are the more worthy of notice, as the preservation of limbs may prove the consequence of their being well considered.

'*When the external wound happens to be small in a compound fracture, an ample dilatation of it at the*

very first dressing, is a point that demands particular attention; that any membranous structures, discoverable by gently introducing the finger, may be set at liberty by knife or scissors, and that coagula of blood, extraneous bodies, loose fragments, and splinters of bone, may be extracted before the parts grow tense, inflamed, and tender, in order to prevent the train of direful symptoms arising from irritation of the sensible parts, and should much of the whole substance of the bone protrude, sawing off a portion of it may hasten the cure, as well as give an opportunity of keeping the limb in a true direction.*

'By this kind of treatment, and such applications as are generally used in large lacerated wounds, in conjunction with a timely observance of a proper regimen, etc., *the formidable accidents, as violent pain, fever, inflammation, etc., may in a great measure be prevented, as I have good reason to believe, founded upon experience, with such success, as makes me think this method, which I have long pursued, cannot be too much inculcated.*'

* Case of compound fracture extracted from Benjamin Gooch's Cases and Practical Remarks in Surgery. Norwich, 1767.

'Many years ago, I was called to see a boy eight years of age, who, five days before, had received a fracture upon his leg, with a small wound, made by one end of the tibia passing through the skin, which ought to have been enlarged at first, and the end of the bone sawn off. The whole leg and thigh was now become emphysematous to a great degree; and this appearance extended even to the lower part of the abdomen on the same side. Incisions were forthwith made in different parts of both leg and thigh, whence air rushed out with an audible hissing noise, and the cellular membrane, which contained this rarified air, was mortified all the way, even where the skin was not so affected. Warm applications were made, and other proper measures taken, but to no purpose. The patient died two days after, in which time the emphysema approached almost to the navel.'

All the fractures, to which these cases refer, have occurred in the continuity of the bones, without involving the joints. It is to this class of fractures I shall especially confine myself; although I may speak of injuries of the joints for the purpose of illustration. They all appear to have been successfully treated, and there is no reason to believe they have been published as cures, while less fortunate cases, managed by the same authors, in a similar manner, have been suppressed. In my own practice, I assure you, there exists no unfortunate result to mar the satisfaction I experience in having abstained from amputating such limbs. Some of the cases here collected, particularly those of La Motte, have been severely criticised. Thus, Mr. Pott says,* 'That La Motte's patient escaped, I make no doubt, because he has said so; but the surgeon showed much more rashness in attempting to save such a limb, than he would have done in the amputation of it. The amputation would have been the more justifiable practice. I should be very sorry to be thought a patron or an adviser of rashness or cruelty; but in what I have here said, I believe I shall have every man in the profession who has either true humanity or sound judgment, founded on experience, on my side.'

But shall we not go on in such efforts, notwithstanding Mr. Pott's criticism, while experience shows us that similar accidents under the care of

* Sir James Earle's edition of Pott's works. Philadelphia, 1819. Vol 1, p. 266.

so many different surgeons, at different times and places, have terminated successfully? Will not the candid believe, that these cases should no longer be considered as mere exceptions to the sound principles of surgery, nor as examples of a single limb saved by sacrificing a dozen valuable lives on the altar of rash and unwarrantable experiment?* Will they not believe that the question ought to be raised, why so many apparently hopeless cases have done well? Why have not tetanus, mortification, irritative and traumatic fever more frequently occurred? or extensive abscesses, burrowing up and down the limb among the muscles, laying the bones bare, and producing hectic fever and colliquative diarrhœa? Will they not inquire why delirium, and severe pain and suffering, have had so little to do in most of these cases, while they so frequently occur, and even prove fatal, in other instances of even less apparent severity?

To bring the whole subject fairly under consideration, let us inquire what is the practice, and what the doctrines promulgated by the ablest surgeons, regarding the treatment of compound fractures. Let us examine these opinions, and compare them

* There can be no doubt but that some persons save their limbs contrary to the opinion of the faculty; but in most of these cases the limbs are useless, and for one saved under such circumstances, ten persons die.—*Guthrie on Gun-shot Wounds. Page* 54.

By a limb saved, I do not mean one with the wounds healed, having, nevertheless, the extremity contracted, bent, motionless, or otherwise useless: cases, which by a loose kind of phraseology, are often termed 'limbs saved.' The object of saving a limb is that it may be useful.—*Medico Chirurg. Trans. Vol* 23, *p.* 246. *Rutherford Allcock.*

with the opinions of surgeons of different times and places, and who practiced under different circumstances. In a particular manner let us look to results, and thence determine what course of treatment should be pursued, by ascertaining what results may reasonably be expected from following out one course of treatment or another.

In a severe case of compound fracture, the first question to be considered is, can the limb be saved and made useful? No one will doubt, that both duty and humanity require that amputation should be performed, whenever a member is carried away by cannon-shot; when so overrun by rail-road carriages, crushed by machinery, or by heavy bodies falling upon it, as to destroy the life of the part below the wound. Generally, however, the question is not so easily settled; but requires great care and circumspection in estimating the amount of the injury on the one hand, and the powers of nature on the other.

Yet, in deciding this most responsible question, the surgeon obtains but little aid from the rules or precepts laid down by systematic writers, even when he has time and opportunity to consult them. Baron Boyer, and in this he is supported by most other systematic writers, tells us,* 'It must depend upon the sagacity of the attending surgeon to decide if amputation be or be not necessary in

* C'est à la sagacité du chirurgien à décider la nécessité de l'amputation.—*Boyer Maladies des Os. Page* 54.

any given case.' This state of things grows out of the nature of the case. It is the surgeon in attendance, alone, who can know and appreciate all the circumstances bearing on this momentous question. It is for him to ascertain and determine, as precisely as possible, the extent of the injury to each and every tissue interested; to what extent such lesion may impede or endanger the vital actions of the broken parts themselves, or of those contiguous to, or dependent upon them for support. It is equally his duty to determine what parts may have escaped injury, and what are their powers of supporting life.

Having acquired this knowledge, it is for him, again, to estimate the powers of nature and of art in resisting and surmounting injuries, and in repairing their consequences. He should understand well the anatomy of the parts interested, and their functions; the circulation of the blood in the smaller arteries and capillaries, and the transmission of nervous influence; he should have studied well the laws of life in health and disease, the nature of inflammation and fever, their causes and effects.

He should be able accurately to estimate the influence of age, constitution, temperament, and all the conditions of life to which the patient may be exposed during the treatment. In a word, to a thorough knowledge of the principles of his

profession, surgical and medical,* must be superadded an acquaintance with the writings of the best authors on the subject, a knowledge of what able men have actually done in similar cases, and the means they have used. He must have enjoyed an opportunity of seeing these principles often tested in clinical practice, and possess a talent to learn by observation and reflection.

Fearful is the responsibility resting upon us, if we sit in judgment, without being properly qualified. We must not trust to precept alone; nor can genius, unaided by education, avail us. Surgical knowledge comes not by inspiration, nor by blindly following in the course of others.

All the circumstances of a given case having been duly considered, and amputation deemed indispensable, this most important question presents itself: shall such operation be performed immediately after the accident, or at some future time? Speaking on this subject, Mr. Bromfield,† an eminent English surgeon of the last century, says: 'As I would not mislead in the case of compound fractures, I therefore declare from experience, that when things are so circumstanced that the operation is unavoidable, the sooner it is

* Que la médecine pour le chirurgien, comme la chirurgie pour le médecin, ne seront jamais que la première des sciences accessoires. Ce fut là l'opinion constante de Desault, qui eût été, sans elle, moins grand chirurgien, par là même qu'il eût un peu plus brillé dans les sciences voisines de la sienne.—*Bichat Discours Prélim des Oeuvres de Desault. Page* 3.

† Vol. 1, page 44.

done, the greater will be the chance of saving the person's life.'

Again, Wiseman,* a man of great ability in his profession, and who had seen much service, both in naval, army, and civil practice, says: 'But it was counted a great shame to the chirurgeon, if that operation was left to be done the next day, when symptoms were upon the patient, and he spent with watchings, etc. Therefore you are to consider well the member, and if you have no probable hope of sanation, cut it off quickly, while the soldier is heated and in mettle. But if there be hopes of cure, proceed rationally to a right and methodical healing of such wounds.'

In several other places in his work, Wiseman cautions us against delay, and adduces examples of its danger and fatal results.

J. L. Petit speaks of the same advice being given him when a young man, (1693,) by a distinguished surgeon of his day, whom he consulted for a patient under his care.†

Ambrose Pare ‡ applies the same doctrine to the

* Vol. 2, page 176.

† Nous sortimes ensemble, et il me dit que, si pareilles blessures me tombaient entre les mains, il fallait couper la jambe, et ne point attendre que les symptomes m'y obligeassent. Je lui en démandai la raison. Il se contenta d'ajouter qu'il n'avoit sauvé de parielles malades qu'en faisant l'amputation, mais qu'elle ne réussissait que quand on la faisait sur le champs. Le lendemain le pied du malade fut presque gangréné. Je fis l'amputation, et le malade mourut einq ou six jours après.—*J. L. Petit, Maladin Chirurg. Page* 803.

‡ The wound must forthwith be enlarged, unless the condition of the part resist, that so there may be free passage forth for the sanies, or matter, as also for sueh things as are fareed, or other ways contained therein; sueh as are

dilatation of gun-shot wounds: and Le Dran announces his judgment in the following words. 'Whenever, in case of a gun-shot wound, the surgeon foresees the indispensable necessity of amputation, he should do it at once.'

While such was the opinion of these distinguished men, the French Royal Academy of Surgery, in the year 1754, proposed the following question for a medal:* 'In what cases is it necessary to perform amputation immediately, and in what to defer it?' The prize was awarded to M. Faure, a military surgeon, for an essay which maintained that amputation should only be performed after the subsidence of the first symptoms, and the establishment of suppuration. Faure based his opinions on the results which he had seen of early and deferred amputation, as practiced on the wounded after the great battle of Fontenoy, which took place, May 11th, 1745. He states these results to be, that scarcely thirty escaped after early amputation, out of more than three hundred operated on; while of ten, amputated after the first symptoms had subsided, all recovered.

Some time subsequently, John Hunter and O'Halloran, in England, embraced the same views.

pieces of their clothes, bombast, linnen, paper, pieces of maille or armour, bullets, haileshot, splinters of bone, bruised flesh, and the like: All which must be plucked forth with as much celerity and gentleness as may be. For presently after the receiving of the wound, the paine and inflammation are not so great as they will be within a short time after.—*Ambrose Paré. Page* 419.

* En quels cas il fallait faire l'amputation sur le champ, et en quels cas il fallait la différer.—*Prix de l' Academie de l' anné* 1754.

Hunter, in his work on Gun Shot wounds, speaking of early amputations, says, 'In general, surgeons have not endeavored to delay it till the patient has been housed, and put in the way of cure; and therefore it has been a common practice to amputate on the field of battle. Nothing can be more improper than this practice, for the following reasons; in such a situation, it is almost impossible for a surgeon, in many instances, to make himself sufficiently master of the case, so as to perform so capital an operation with propriety; and it admits of dispute, whether, at any time and in any place, amputation should be performed before the first inflammation is over. When a case is so violent as not to admit of a cure in any situation, it is a chance if the patient will be able to bear the consequent inflammation; therefore, in such a case, it might appear, at first sight, that the best practice would be to amputate at the very first. But if the patient is not able to support the inflammation arising from the accident, it is more than probable he would not be able to support the amputation and its consequences. On the other hand, if the case is such as will admit of being brought through the first inflammation, although not curable, we should certainly allow of it; for we may be assured that the patient will be better able to bear the second.'

Again, 'In the first case it is only inflammation; in the second it is inflammation, loss of substance,

and, most probably, loss of more blood; as it is to be supposed that a good deal has been lost by the accident, not to mention the awkward manner in which it must be done.'

In another place, 'experience is the best guide, and I believe it is universally allowed by those whom we are to esteem the best judges, those who have had opportunity of making comparative observations on men who have been wounded in the same battle, some, where amputation had been performed immediately, and others, where it had been left till all circumstances favoured the operation; it has been found, I say, that few did well who had their limbs cut off on the field of battle; while a much larger proportion have done well, in similar cases, who were allowed to go on till the first inflammation was over, and underwent amputation afterwards.'

Here we see Hunter* appeals to the experience of other military surgeons. To whom he alludes does not appear from the text; but it may

* Hunter became senior surgeon on the staff in 1760, went to Belle Isle and Portugal in 1761, and left the service in 1763. In the introduction to his treatise on inflammation and gun-shot wounds, he says that work was first arranged during the year 1762, being eight years after the award of the academy; a period well calculated to give to the opinions of Faure and of the academy, all the currency and influence usually exercised over public opinion by great reputation, sustained by the authority of powerful and learned associations of men of distinguished and acknowledged ability.

The short period of service here mentioned, together with the appeal of Hunter to the experience of other military surgeons, rather than his own, leaves but little doubt, that the views of Faure had too much influence over his mind, and that he did not give the subject all the attention and comparative examination which its importance deserved.—*See Life of Hunter prefixed to his works.*

be he refers either to Faure himself, or to those who had entertained his views.

When we remember that Hunter, in England, undoubtedly stood at the head of his profession, both in military and civil practice, that Faure enjoyed a high reputation from the great success which, he alleged, had crowned his efforts, that he was honored by the medal of the academy, and still more by the approbation, countenance and friendship of the distinguished surgeons who constituted that learned body; when two such men, under such circumstances, unite in recommending one course of practice as safe and proper, and at the same time tell us, that whenever that course is deviated from, the most disastrous consequences ensue; we cannot be surprised that their doctrines should exercise great influence over the opinions and the practice of the civilized world. Such has been the case here; and I believe I may state, that the practice of deferring amputation, when made necessary by casualty, until after the subsidence of the first symptoms, was enjoined upon the military surgeons of Europe, and generally approved by distinguished men in the civil exercise of the art, from the days of Faure to the time when, in France, Baron Larrey, and in England, Dr. Hennen and Mr. Guthrie, established the fact upon the fullest evidence, that both Faure and Hunter were in error, and that where amputation is necessary in consequence of gun-shot

wounds, and, I may add, of other casualties, such operation ought to be performed at once, or within twenty-four hours from the receipt of the injury; that when amputation is practiced before the access of the consecutive symptoms, it may be done with but little comparative danger; that when it is done after the appearance of such symptoms, and before suppuration is fully established, fever allayed, and the system restored, as it were, from its influence, the danger is urgent, and the result usually disastrous; finally, that if delayed until after all these symptoms have given way, swelling subsided, and suppuration has been established, a better chance of recovery may exist; but still, this chance is much less than if the operation had been done immediately, on the receipt of the injury.

In support of the propriety of immediate amputation, Baron Larrey adduces the testimony of Dubor, who stated, that during our revolution, the American surgeons performed amputation at once, and lost but few of their patients, while, among the French auxiliaries, the surgeons delayed it, in accordance with the doctrines of Faure, and lost a very large proportion of theirs.

He also mentions the testimony of Féroc * and

* ' Lors du combat naval du 13 Prairial, an. 11, (1er Juin, 1794,) il fut fait un grand nombre d'amputations l'instant après le coup. Soixante de ces amputés furent portés à l'hôpital de la marine, à Brest, et confiès aux soins de M. Duret. Deux seulment périrent du tetanos; tous les autres furent guèris: l'un d'entre eux avait eu les deux bras amputés.'—*Larrey Chirurgie Militaire. Vol* 2, *p.* 489.

other naval surgeons, that out of sixty patients on whom amputations were performed in the French fleet immediately after the combat of June 1st, 1794, but two died, and that all the rest recovered; one having lost both arms.

Mascelet also states, that immediately after the naval battle in Aboukir bay, eleven amputations were performed, all successfully; while, at the hospital on shore, three operations were performed, seven or eight days after the battle, and that all the patients died, notwithstanding the best care.

To all this Baron Larrey * adds the evidence of his long and careful experience; he says, 'Faure assures us that hardly thirty escaped after the battle of Fontenoy, out of about three hundred who underwent early amputation, while in our practice, more than three quarters have been saved and some of them with the loss of two limbs.'

The doctrines above stated are confirmed both by Dr. Hennen and Mr. Guthrie, in their inestimable works on military surgery; they also adduce the opinions of other military surgeons in support of their own. They examine closely the doctrines of Hunter, and admit that they must be erroneous. Mr. Guthrie says that previous to the termination of the war of 1815, the opinions of Hunter on the powers and capabilities of the human consti-

* 'Faure nous apprend que sur trois cents amputations environ, faites après la bataille à Fontenoy, une trentaine seulement furent suivies de succès, tandis que nous avons sauvé plus de trois quarts de nos amputés, dont quelques-uns ont même perdu deux membres.'—*Larrey Chirurgie Militaire. Vol* 2, *page* 452.

tution were universally received. As general principles, they did little mischief; but when they came to be acted upon, the results were not found to coincide with the principles from which they were deduced, and I do not believe, says Mr. Guthrie, that at the close of the war in 1815, there was one naval or army surgeon in the British service, who would have delayed, until the second period, an amputation which was clearly indicated to be necessary, although there were a few, in the French army, who preferred operating after the first inflammatory symptoms had subsided. This was not the case in private life. Many of the surgeons, in London and other places, advocated the propriety of delay, and the opinions of Hunter, and taught to rising surgeons, doctrines which had been found wanting in practice, and which could not be too soon exploded.

I may here observe, and it is a point of the greatest importance in understanding the question at issue, that Baron Larrey, Mr. Guthrie, and Dr. Hennen, confine the period of time, proper for primary operations, to the first twenty-four hours after the infliction of the injury. Baron Larrey tells us,* 'When a limb has been so injured by

* 'Lorsqu'un membre blessé par un coup de feu ne peut être conservé, il faut l'amputer sur le champ. Les premières vingt quatre heures sont les seules heures de calme que conserve la nature, et dont il faut se hâter de profiter, comme dans toutes les maladies dangereuses pour administrer le remède necessaire.—Si l'on ne fait promptement l'opération, la douleur se manifeste, la fièvre s'allume, les fonctions sont dérangées successivement, l'irritation augmente, et il se déclare

gun-shot that it cannot be saved, we should amputate immediately. The first twenty-four hours are the only hours of quiet which nature enjoys. It is therefore during this favourable period that we should apply our remedies, in this, as in all dangerous diseases.'

In the sixth volume of the Memoirs of the French Academy of Surgery, page 118, we find the following excellent critique by Boucher upon the doctrines of Faure, written soon after the award of the academy. It is precisely the doctrine established by the experience of military surgeons of the present age. Boucher says,* 'Properly to discuss this important question, we should mark the different periods of time when amputation should be performed. And I will mention three. The first period, extending from the receipt of the injury to a short time before the

des mouvemens convulsifs. Si le malade ne succombe pas à ces premiers accidens, les solides, après avoir été distendus outre mesure, tombent dans une atonie complète ; ce qui produit dans le moignon la gangrène dont il est difficile de prévenir les suites funestes.'—*Larrey, Chirurgie Militaire. Vol.* 2, *page* 453, 455.

* Pour procéder avec ordre dans la discussion de cet objet important, il faut distinguer avant tout, les temps ou les divers périodes, dans lesquels l'amputation peut être pratiquée. J'en distingue trois.

Premièrement, le temps qui suit immédiatement le coup porté, et qui précède le développement des accidens. L'on sait que dans les plaies faites par armes à feu, la tension, le gonflement inflammatoire, les battemens, les douleurs vives, &c. qui en sont les suites ordinaires, n'ont pas lieu tout d'abord, et que ces symptomes tardent plus ou moins à se montrer selon la grandeur et la complication de la plaie a quoi contribue aussi le tempériment ou la constitution du blessé.

Secondement, le temps, ou les accidens plus ou moins développé, sont plus ou moins propres à affecter l'economie animale.

Troisièmement, le temps, ou les grands accidens ont rélâchés de leur violence ou sont absolument calmés — Temps requis par M. Faure, pour operer avec avantage.—*Boucher Mémoires de l'Académie de Chirurg. Vol.* 6, *page* 118.

appearance of the inflammatory symptoms. The second commences with these symptoms and continues during their influence. The third commences when the symptoms have become much mitigated in their violence, or have wholly subsided; the period considered by Faure as the only proper time for amputation.'

In speaking of the symptoms resulting from wounds, and the period of their access, Boucher says, 'We well know that tension, inflammatory swelling, and pulsating pains, fever, etc., do not take place at first; but that the period of their access is more or less influenced by the extent and complication of the wound, and by the temperament and constitution of the patient.* Faure's system appears to be founded wholly upon the unfortunate results which follow amputation, practiced during the second period, when all the symptoms are developed, since he alleges that the little success, which followed primary operations, was owing to the fact, that they were done in a time of trouble and disorder; when the whole machine was, as it were, in a state of ardent fever.'

* Boucher here gives us a most important principle, which should be well observed in practice. Baron Larrey confines the time proper for amputation, to twenty-four hours after the injury; experience having convinced him that the inflammatory symptoms usually commenced within that time. It is probable, however, that in some instances, the symptoms may be delayed beyond this precise time. It is even more true, that, owing to the peculiar complication of some wounds, the severe symptoms commence at a much earlier time. In confirmation of this opinion, see Larrey Chirurgie Militaire, tom. II, page 260; case of Gen. Lanusse. See also the cases lettered A. B. C. annexed to this essay.

He also remarks, 'After the battle of Fontenoy,* there was such lack of surgeons, that but few of the wounded could receive proper care.' Thus it seems, that Faure did not confine his observations to the first period of Boucher and of Baron Larrey. We may reasonably infer, from an accurate examination of the opinions, both of Faure and of Hunter, either that they did not recognize this most important practical precept, or that they disregarded it in practice.

If this be the explanation, and I doubt not that it is, then it is established, that in the days of Faure and of Hunter, as well as in our own, and I doubt not the same will hold true as long as time lasts, neither amputation, nor other operation of surgery, can be performed on the human body, while suffering under inflammation and fever, without incurring the greatest danger. I have labored this point, gentlemen, extensively, and I fear tediously, not only because it is applicable to military surgery, but for the stronger reason, that it is equally applicable in civil practice; alike to the treatment of compound fractures, and to any operation which may be proposed while the human system is in a state unfavorable for its execution. If, then, amputation is not to be performed in a compound fracture, from the commencement of the second

* Smollett says this battle was fought with great carnage and obstinacy. At first the French were driven from their position, but regained the field and a complete victory. The Allies lost 12,000, the French nearly the same. The English left all their wounded to the mercy of the French. This fact and the time the battle lasted confirm the views of Boucher.

day after the injury, until suppuration has been established, does it not follow, by a parity of reasoning, that we should avoid, during the same period, all acts which may promote or aggravate inflammation? Does it not also follow, that every thing possible should be performed on the first day,* and that every act which can, in any way, excite or aggravate inflammation or irritation,†

* I cannot here refrain from warning the reader of the necessity of making all his arrangements with the greatest care and forethought. It is not sufficient that he knows how to remedy difficulties when they arrive; he must foresee and prevent them. The medical treatment is of great importance. Is blood to be taken? If so, from what part? When? and how much? Similar queries present themselves as to purging,* diaphoretics, and opiates. The articles selected for diet should be such as best tend, in conjunction with other means, to subdue fever and irritation; yet such as may be most nutrient, consistently with the foregoing condition. The patient's apartment should be quiet, free from noise and interruptions, and thoroughly ventilated, having a southern and pleasant prospect. Perfect cleanliness should be observed. The attendants should be intelligent, firm, and uncompromising to baneful indulgences; yet still more noted for kindness, cheerfulness, and sympathy for human suffering. Such apparatus only should be used, as may retain the parts in apposition, without giving pain. The transportation of the patient home, without injury, is of great importance. On this subject, see the Memoir of M. De La Faye, Mèm. De L'Acad. Vol. 6, page 1; and for a translation of the same paper, see J. Aitkin on Fractures, page 79. London, 1800. See also Baron Dupuytren, Leçons Orales.

'Hic tamen citra curationem notandum, primo, ut fiat extensio a chirurgo statim vocato, primâ, aut ad summum, secundâ die, priusquam scilicet, parti gravis superveniat inflammatio. Si Chirurgus opportunè non fuerit accersitus, sed tertiâ, quartâ aut quintâ die, in quibus inflammatio vel imminet vel coepit, tunc tentanda non est extensio, donec septem, vel paulo plures dies praeterierint.'—*Scultetus. Page* 90.

† 'Il y a long-temps qu'on a dit pour la première fois qu'on ne devoit negliger aucune precaution dans le traitement des maladies. L'omission d'une seule circonstance peut conduire a des resultats facheux.'—*Baron Dupuytren Leçons Orales. Vol.* 5, *page* 9.

* 'Purgatio enim per alvum plerisque vulneribus prodest.'

should be most studiously * avoided during the intervening time preceding suppuration?

Is it not clear that all membranous structures, which, in consequence of the injury, have become so many bands, impeding or even arresting the circulation of blood, or the transmission of nervous influence, should be at once divided? Shall we in compliance with the rules of our art, remove from our bandages both hem and seam,† lest they irritate or cause ulceration of the skin, and at the same time suffer rough, angular, loose fragments of bone or other foreign bodies to remain within wounds to irritate, inflame, and endanger the vital ‡ structures they may lie in contact with?

Shall we any longer talk about the necessity of

* 'I am informed that amputation of the angular portions of fractured bones is not uncommon at the Leeds infirmary. Whether it has been attempted under such circumstances, and to such an extent as has been already detailed, I am not aware; as important facts are frequently buried within the walls of an hospital. I must acknowledge, however, that on speaking to the venerable Mr. Hey, on the bad consequences of compound fractures in London, he assured me that he was persuaded, that it was not so much from the foul air, as from not removing the sharp ends of bones, which irritated the muscles and became a constant source of tetanus, or of those extensive suppurations so often followed by death. He told me, by adopting this plan, his practice was very successful.'—*Mr. Dunn, Medico Chirurg. Transactions. Vol.* 12, *page* 176.

† 'Fasciae autem parantur ex linteis vetustis aliisque usibus ex parte attritis, ut sint tractabiliores, validis tamen, ne extentae lacerentur; nullas consutiones aut extantias habeant, ut æqualiter, ac sine dolore constringant.—*Scultetus, page* 83.

‡ 'Those fractures are most dangerous, which are made so deep in the fleshy parts, that your hands cannot well come at them to extract the loose bones, and place the others right * * * so also those fractures made by splinters are exceeding dangerous, they generally shattering the bone to pieces: In which case, the nerves, tendons, etc. are grievously pricked and torn, and are subject to extraordinary pain, inflammation, convulsions and death, unless immediate remedy be had by removing these bones, or by amputation of the member.'—*Wiseman, vol.* 2, *page* 174.

cleanliness, and busy ourselves with water, soap and sponge, in washing the external coverings of a broken limb, knowing full well at the time that this very limb is, within, full of all uncleanliness?

Shall we recognize any longer as a principle of our art, that in such cases, it is nature alone which has power, after weeks of suffering and danger, to relieve our patients, by removing the complication of their wounds, whence all their sufferings and danger come?

It is on the above principle that we may explain the not unfrequent occurrence of serious consequences, or even death, after operations, deemed trivial, when practiced on inflamed parts; such even as cutting corns and paring toenails. I fear this subject has not received the attention it deserves from the profession, in private practice, and that principles, which may be said now to be well re-established among military surgeons, are not duly appreciated either in the hospital or private practice of Europe or America.

To elucidate this point, I will mention a single case which came under my knowledge some twenty years since. An industrious middle-aged man,* foreman of a distillery, residing in a neighboring town, had been afflicted a long time with a corn on each foot, over the joint of the little toe and its metatarsal bone. On each foot, the corn had caused ulceration into the joint. The bones

* The late Mr. Burrage of Medford.

were carious, and the patient suffered much from lameness. To obtain relief, a surgeon was consulted, who recommended the removal of the little toe and a portion of its metatarsal bone; but he added it could be safely done, only after the patient had confined himself to a recumbent posture, appropriate diet and regimen, with such medicine as might be needed to subdue all inflammation, swelling and tenderness. This course was adopted, and the toe, which had given the greatest pain, removed at the proper time. No bad symptom ensued; cicatrization took place in a reasonable time, and the patient then regretted that both feet had not been served alike. On returning to his labors, the man experienced so much relief from the operation, and so much pain from the remaining toe, that he determined to lose that also. He again applied to the same surgeon, but declined wasting, as he termed it, so much time in preparation. He said there was almost no pain in the part, except when he walked; that it was very different from the other, and that now he must have his own way. Finding his surgeon inexorable, he applied to another, who entertained no such scruples. The operation was done expertly and quickly, but it caused great suffering in its execution. Within a few hours, there ensued most agonizing pains. Opium was resorted to, but without relief; the patient became delirious, agitated, and sleepless.

The wound assumed a bad appearance, soon mortified, and death was the result.

In considering those cases that heal without suppuration, it may be well to inquire how far fortunate results are dependent on treatment, and how far on peculiar complications.

Sir James Earle, in a note to his edition of Pott's treatise on compound fractures, considers all the aggravated symptoms as dependent upon the admission of air into the wound, among the fractured bones. In support of this opinion, he reasons from analogy, and says that large extravasations of blood may remain harmless, and that psoas abscesses may exist for a long time, and increase to great size, without producing trouble to the system; but hectic fever and other grave symptoms supervene as soon as an opening is made and air admitted. But it may be well questioned if the analogy holds good in compound fractures. These views are certainly not sustained by the cases collected and hereto annexed, as neither hectic fever, inflammation of a grave character, or severe pain, or nervous symptoms have occurred in either of them, where the wound was at once sufficiently open, drained of liquid discharges, and freed from all foreign bodies: while severe symptoms have attended some of the other cases, where these precautions have not been sufficiently regarded: yet here, on several occasions,

the severe symptoms * vanished, as soon as the needful treatment was adopted.

I will only add, that I have, on many occasions, known compound fractures heal readily as by first intention; but this result has been obtained only in cases where the wound has been inflicted on the bones and muscles, without splintering, or other important complication; while the severest symptoms have followed such fractures as have occurred in tendinous and membranous parts, where the bone was much splintered, and the skin but little broken. Most English and American surgeons, however, have adopted the views of Sir James Earle, and have endeavored to convert compound into simple fractures, by closing the wound by means of adhesive plaster and bandage, in the hope of healing by first intention.

Now although there may be but little objection to gently drawing the lips of the wound together by adhesive plaster, in the simpler kinds of compound fractures, I mean such as are compound by definition, not by complication, yet I apprehend much mischief may flow from the practice, if extended to the more complicated forms of fractures, especially when, in addition, graduated compresses and bandages are made use of to prevent the undue

* In support of the opinion, that air may be freely admitted to the cavity of compound fractures without injury, see case No. 7. See also, the cases lettered D. E. F. G. These cases and No. 6 also illustrate the value of draining all fluids from the wound, at the commencement, and during the whole course of treatment.

rising of the bone.* Under such treatment I doubt not that inflammation and sloughing have often been attributed to the original injury, which would never have existed, had it not been for undue constriction over the wound.

Closing here our remarks on the cases in which amputation has been pointed out as the appropriate remedy, and on those which are so little complicated, that they may be healed with little or no suppuration, and without inducing aggravated or dangerous symptoms, let us consider those intermediate cases, where alone the question of dilatation, and the extraction of foreign bodies, properly arises.

In the commencement of this investigation, the inquiring mind is struck by the fact, at once curious and instructive, that the older surgeons, both English and French, the Parés, the Wisemans, the Petits, the Bromfields, the Le Drans, and the Bouchers, agree in recommending immediate action, both as applied to amputation, the dilatation of wounds, and the extraction of foreign bodies therefrom, whenever such cases were so complicated as to render such proceedings necessary. And it appears that their doctrines and practice

* On doit éviter les bandages unissants tels que la capeline, et autres semblables; ils gènent et fatiguent les parties, en s' opposant à l' éngorgement favorable et nécessaire pour produire une bonne suppuration.—*Larrey. Vol.* 2, *Chirurgie Militaire, page* 481.

Fasciæ etiam minus stringuntur, quam in fractura sine vulnere, ne compresso vulnere, dolor et inflammatio oriantur.—*Scultetus. Page* 90.

were recognized as correct, and followed, up to the time of Faure and of Hunter; that since that time, the opposite principles and practice, as taught by the two last mentioned writers, have been established, both in military and civil surgery, and, except so far as before pointed out, in regard to the time of performing amputation, continue to this day to be generally regarded as correct.

The older surgeons * above cited, allege that severe and dangerous symptoms supervene in wounds complicated with broken bones, unless tension be prevented or removed by incisions, and foreign bodies extracted, before the commencement of inflammation; and that these symptoms are dependent upon the complication of the wound † and may be relieved, controlled, or even prevented by appropriate and seasonable treatment. Baron Larrey embraces the same views, and Dr. Hennen

* As long as there is any strange body or different substance to keep off the unition, you must not hope to make any cure of the wound.—*Wiseman, vol.* 2, *page* 43.

Wiseman, vol. 2, page 158, having advised immediate extraction of all foreign bodies, says in the succeeding paragraph:

'In the Armado naval of Dunkirk, where the chirurgeons were oft employed in this kind of work, we, after every fight, went together, visiting one another's wounded men. It was thought amongst us a great shame, if any thing of this work of extraction were then to be done: For after the first and second day, the wound proveth tumefied, also the neighbouring parts are inflamed, and so changed in their temper, that they conceal from your sight both the bullet and his companions, so that the place they are caught in can hardly be known; Or, being discovered, you can not, without hazard of your patient, or great trouble of the part, make extraction of them. In which case, it may then be reasonable to defer that work, and by lenients to hasten digestion.'

† See case No. 18, as exemplifying cause and effect between dilatation and relief of the severest symptoms.

and Mr. Guthrie base their doctrines of immediate amputation upon the same principles. They all appeal to experience and cite many cases confirming the doctrine. On the other hand, Faure and Hunter appeal to their experience, and to that of others, to prove the success of treatment diametrically opposite. How, then, are we to reconcile this difference of opinion with regard to matters of fact? No one will believe that either Faure or Hunter would deceive themselves or willingly mislead others. Some mistake must obviously have existed, and I have already adduced the authority of Boucher, proving, as it seems to me, that Faure actually did fall into the error of confounding the first and second periods of Boucher and of Larrey. Consequently, all his deductions fall to the ground, as they in no wise militate with the views of the opposing party. We are therefore compelled to believe, that the error lies in not understanding, or in disregarding the principles so clearly laid down, above, on this subject, and we realize, with painful emotions, how much more creditable it had been for science, as well as fortunate for humanity, if both Faure and the members of the Academy had studied and appreciated the criticisms of Boucher, and governed themselves by his wisdom. Nor is it less certain, that Hunter fell into the same error: his writings contain strong internal evidence of this fact. He insists that patients should be housed and put in a

way of cure, before any operation is performed; thus causing delay and wasting most valuable time. He says, 'that the extraneous bodies do not come out from wounds, at first, so readily as they do at last, because the inflammation and tumefaction, which extend beyond that very opening, keep them in:' thus showing, conclusively, that he speaks of wounds only when inflammation and tumefaction have already supervened, and when the favorable moment for action has passed by. In another place, he considers tension and inflammation as the consequences* of wounds, and that dilatation must increase them both, inasmuch as it extends the original wound. Hunter, and Pott, and Abernethy, speak much of the injury arising from any effort to remove foreign bodies, or fragments of bone, except such as are loose and superficial, until after suppuration has been established; thus showing, that they speak only of the case during the second period, the period of inflammation. They object even to the use of probes, as a violence offered to the parts, and neither recommend early dilatation for the purpose

* A reason given for opening gun-shot wounds is, that it takes off the tension arising from the inflammation, and gives the part liberty; this would be very good practice, if tension or inflammation were not a consequence of wounds; or it would be very good practice, if they could prove that the effects from dilating a part that was already wounded, were very different, if not quite the reverse of those of the first wound, but as this must always be considered as an extension of the first mischief, we must suppose it to produce an increase of the effects arising from that mischief: Therefore this practice is contradictory to common sense and common observation.—*Hunter on Gun Shot wounds.*

of draining,* or of preventing, or relieving, tension, or for the removal of foreign † bodies; nor do they in any way mention, or allude to, the reasons assigned by the older writers, for urging these important and necessary operations;‡ much less do they meet their arguments and show them to be fallacious.

* The English custom of healing wounds in general by the first intention, as well as Hunter's doctrine of the vitality of the blood, and its power of becoming organized, together with his views of the bland and inoffensive nature of pus, have all, I doubt not, tended, in common with the views of Sir James Earle, to establish the practice here alluded to. Consequently, the deleterious influence, on health, of matter being retained and burrowing among the soft parts, and the danger of purulent absorption or infection, have, till within a few years past, been too much overlooked, or disregarded. As illustrative of the baneful influence of matter so retained, I have placed, in the appendix, one case from the works of Ambrose Paré, lettered G, and one of my own, lettered F. I likewise make the following quotation from Tulpius, to show that physicians, as well as surgeons, of his day, agree on this subject: 'Sed in diutinâ suppuratione, languet, vel potiùs emoritur tantoperè, vis expultrix: Ut multo facilius expellat onus suum, perviam declivem quam sublimem. * * * * Dirige itaque cursum tuum, o Medice, per lineas hic signatas: Et excipe gratè quod praefertur lumen: Sed scca maturè constantibus viribus, et integris visceribus: Alias educes quidem pus vel cruorem: Sed neutiquam ex periculo aegrum.'—Nicholai Tulpii Observationes medicæ Editio Quinta Lib 2, Caput 5, Lugduni Batavorùm 1716.

† Mr. Abernethy, in his lectures, says, when speaking of compound fractures much comminuted, 'I do not see what advantage can be derived from picking away the smaller pieces of bone. The only mode in which the fracture can unite is by the separate pieces of bone becoming vascular, and the probability appears to me that they will become more so, when the pieces are small, than when they are very large. If there should be any projecting, detached pieces of bone which appear very much to disturb the proper position of the fracture, you should take them away; but you must be much guided by circumstances: if you can replace the different pieces of bone, and by giving the part a moderate degree of support, retain them there, I think you had better not take them away.'

‡ 'There still prevails, among foreign surgeons, and particularly the French, a strong prejudice in favor of the immediate scarification or dilatation of all gun-shot wounds. This practice originated in the idea, that the wounds were poisoned: to allow, therefore, of a free discharge of the poison, and to admit of the more ready application of antidotes, was a leading indication. To change the figure of the wound was also another object; for the older surgeons had observed, that the more malignant and obstinate ulcers were of a circular form. But the employment of scarifications had its opponents, and was reprobated by Leonardus Botullus, one

All that they say of the bad effects of early operations on broken limbs, has been recognized as true when applied to such operations performed during inflammation,* both by the older surgeons and by the military surgeons of the present day; and we can account for the fact, that but one in ten escaped under the care of Faure, and that under that of Hunter, but few recovered, who underwent early

of the most judicious of the older surgeons. Our own Hunter, between whose opinions and those of Botullus there is a very remarkable coincidence, has contributed very much to show the inutility of the practice. And among English surgeons, the knife is now rarely, if ever, employed in the first instance, except for the purpose of extracting balls, or splinters of bone, and other extraneous bodies; or for facilitating the application of ligatures to bleeding vessels.'—*Hennen.* *Page* 60.

* The idea here advanced, by Hunter, that tension is the consequence of wounds, and increased by dilatation, must be considered as remarkable. An abscess, forming beneath the fascia of the palm, is attended with great pain, throbbing and fever, even when the quantity of matter is small. Here, say we, is tension. We cut at once through the firm, unyielding textures, and let out the matter. Our patient is relieved and his hand recovers its full powers. If this be not done, the matter burrows downward and upward, even through the annular ligament, or perforates the hand, and there finds an insufficient outlet, and the hand often becomes crippled for life. In parts not covered by membranous tissues, much greater suppurations occur without acute or pulsating pain or fever. Hence is it clear, that tension is only the secondary effect; in other words, depends on complication. Why should not this doctrine and practice be applied in treating compound fractures? All wounds, in order to heal, must inflame and swell, to a certain degree. It is inordinate swelling, only, which requires the interference of surgery. The absence, or the entire subsidence, of swelling, on the third day, or at any subsequent time, before suppuration, even when unattended by other bad symptoms, indicates great danger. Witness the following history, viz: 'A person having been shot in the arm, and the wound undigested, I being consulted, advised the laying open of the wound, and the extraction of the bullet, rags, &c., but was overruled by others, and it was deferred to farther consideration. Two days after, I visited the patient, and asked the chirurgeon whether he had laid open the wound? He replied there was no need, for he could turn his finger in it, and pull out the bullet and rags if it was necessary. As I was going out of the house, I met the physician, who, inquiring of me the patient's health, I replied that the chirurgeon had unwittingly given me the certain sign of his death. For, 'In magnis vulneribus et parvis, si tumores non appareant, ingens malum.'—*Richard Wiseman.* *Vol.* 2. *Page* 213.

amputation, only upon the supposition, that both these distinguished men had fallen into the unfortunate mistake we have attributed to them.

Thus bitter and fatal are the fruits of error in our profession, and thus are illustrated the truth and pertinency of the language of Bichat, applied to the merits of Desault, who says, 'We can appreciate the merits of great men only after the lapse of time. It is time alone which can separate the valuable truths they have taught, from the errors which have escaped them. Whoever would accurately estimate their merits, must examine their works in an age subsequent to that in which they have lived.'*

By comparing the results obtained under these two opposite modes of practice, we find the picture by no means flattering on the side of Hunter and his followers. As evidence of the fact, I offer you an abstract of several clinical lectures delivered by Mr. Guthrie,† in London, during the winter of 1837-38.

In beginning, he assumes that compound fractures, whether caused by gunshot, or by heavy bodies crushing a limb with its bones, are nearly similar, and require nearly similar treatment.

'* Tel est en effet le sort des savans; leur merite ne s'epure q'au creuset du temps, les verités qu'ils ont tracés, ne s'isolent qu'en s'eloignant de nous, des erreurs qui leur sont echappées. Qui veut bien les voir, doit se placer toujours dans la posterité.'—*Bichât, Eloge de Desault, Page* 2.

† See Appendix to Johnson's Medico Chirurg. Review for April, 1838, and compare it with the authors mentioned in this essay. See Extracts, Letters H. J. K. L.

With Hunter, he objects to dilating the wound, at first, although he says it must be done at a later period. He says, when suppuration is fully established, the splinters may be very gently sought after and removed. Again, he says, it must be borne in mind, that the pieces of bone cannot all be removed at once, or at the first, or at succeeding examinations; and as they cannot come away of themselves, except they are small, incisions must be made for their removal, and before any quantity of new bone can be formed around them. Mr. Guthrie considers the danger of dead pieces of bone, being inclosed by new formed ossific matter, as very great, and he exhibited to his class several morbid specimens, which had so annoyed the lives of his patients, that they obtained relief only by amputation, or death.* To prevent this state of things, he directs that as soon as it can be ascertained, by passing a probe through a hole in the new forming bone, that a portion of dead bone is so imprisoned, we should cut down upon the part and remove it by the chisel.

Such operations, he says, cannot be all done at once, but only in successive times, as evidence of the imprisoned condition of the bone may be obtained.

Here let us remark, that the time pointed out by Mr. Guthrie for the performance of these operations, is the period when the soft parts are tumid from preceding inflammation: when they are so massed

* See Authorities lettered H. J. L.

together that we can with difficulty recognize the several tissues; and when it would seem that nature should not be interrupted while she needs all her powers, aided by the skill of the surgeon, to complete the restorative process.

Again, it would be difficult to assign a reason, why these important and necessary operations should be delayed to so late a period, since Mr. Guthrie recognizes the necessity of amputating before the access of inflammatory symptoms, for reasons as applicable in the one case as they are in the other.

In Benjamin Bell's System of Surgery, well known, until a few years since, as a textbook for students, we find the following remarkable paragraph.

'From the difficult treatment and uncertain event of compound fractures, practitioners have been very universally disposed to consider the amputation of the fractured limb as necessary.'

And Sir James Earle * tells us, that the surgeons of London, who attended on Mr. Pott for a compound fracture, had actually decided upon the necessity of amputating his leg. That he, (Mr. P.) had given his consent to such proceeding, that the instruments and dressings were actually got in readiness, and that this cruel operation was prevented only by the fortunate arrival of Mr. Nourse, who thought the leg might be saved. Mr. Pott's

* See life of Pott, prefixed to his works.

fracture healed by the first intention, and Sir James would have us believe, that this fortunate result depended upon the oblique course of the bone through the integuments, and the exclusion of air from the cavity of the wound.

But I fancy, gentlemen, you will assign a very different cause for this result; and I trust no fellow of this society will have occasion to regret having advised amputation for the cure of a fracture, so little complicated as to admit of reunion by first intention.

According to Mr. Pott, the great objects of fear and apprehension in a compound fracture are pain, irritation, and inflammation. That these are to be avoided, prevented, and appeased by all possible means, let every thing else be as it may. In these views Mr. Pott agrees perfectly with the older surgeons. On both sides, therefore, is it admitted, that such symptoms indicate great danger, and that the patient's safety requires that they should be promptly relieved. As to the cause of the aggravated symptoms, however, Mr. Pott differs from the older writers, and attributes their existence to the original injury, or to faulty treatment on the part of the surgeon, and not to complication. True to this bias, he resorts only to antiphlogistic remedies for their removal.

But, according to his own account, his success is by no means great; as he says of compound fractures which do not heal by first intention, they

are attended with high inflammation, multiplied abscesses, and large suppurations, demanding all the surgeon's care and skill, and even then sometimes ending in the loss of limb, of life, or of both; or that all our efforts prove fruitless from the beginning, and that gangrene and mortification are the inevitable consequences of the accident.

Now if the extent of the injury be the true measure of danger, in compound fractures; if the surgeons of London can in any way be excused for the opinion given in Mr. Pott's case; or Benjamin Bell's advice be sustained: or if Mr. Pott's opinions be founded on pathological truth — then should it follow, that no one of the cases, which I have the honor to lay before the society this day, could have been brought to a successful issue.

Yet have they all recovered. Mr. Pott and others may say they are exceptions to the sound principles of surgery; but if we examine carefully, we shall find, that the very extent of the wound has prevented tension in the circumference of the limb, by dividing the membranous fasciae which might otherwise have produced it; that the shortening of the bone, by loss of substance, has prevented tension in the direction of the length of the limb, by the relief it has given to the muscles, when suffering under inflammation or engorgement, or from infiltration of blood or other fluids into their textures; that the open state of the wound has also provided a free draining of all fluids, and thus prevented the

lodgment of pus and the formation of burrowing abscesses; and that the extraction of all the foreign bodies, fragments, and shivers of bone, have ensured freedom from pain and other aggravated symptoms, by removing the complications on which such symptoms alone depend.

It was my intention, gentlemen, originally, to consider each of the precepts at first alluded to, separately; to lay before you more fully the arguments adduced by the older surgeons in support of their opinions, and to cite more extensively from their works, cases, proving their opinions to have been practically correct. I also intended to discuss the subject of bandaging, and to compare the effects of too tight binding with those of tension in the circumference of the limb, hoping, thereby, to put the profession on their guard against what, I doubt not, has been a fruitful source of ill success in the treatment of compound fractures. I meant, likewise, to consider the injury of blood-vessels and nerves, and to pass in review the principles and practice advocated, in this particular, by White, Gooch, Delpêch, and Dupuytren, and to bring out in relief, if I were able, the very lucid and invaluable observations of Mr. Guthrie on this subject, which are to be found in his treatise on the Arteries. Lastly, I intended to allude to the great number of cases of compound dislocation of the ankle, (cured without amputation, particularly when part of the bones have been removed,) to be found, scattered

here and there through the annals of surgical literature, and, in a particular manner, to notice the papers of the late Mr. Henry Earle, and of Mr. Rutherford Allcock, in the Medico Chirurgical Transactions, and to have compared the cases here collected, and the doctrines here advanced, with the doctrines and practice inculcated by the invaluable treatise of the late Sir Astley Cooper, on fractures and dislocations of the joints. But as that treatise is now in the hands of every Fellow of this Society; as the great truths therein contained, are given in language so graphic and plain, that 'he that runs may read;' and as nothing therein contained, can, in the present state of our knowledge, be altered for the better, I will only ask of the Society to compare, at their leisure, the doctrines of the one with those of the other, and determine if the work of Sir Astley does not confirm the views here advocated.

But I find I have neither the time nor the ability to do justice to this important theme. I will, therefore, here close, referring you to the works of these great masters of our art, where you will find the subjects ably and candidly discussed; and the appropriate practice accurately described and clearly pointed out. And I trust, when you shall have either formed or renewed an acquaintance with Paré, with Wiseman, with Petit, with Gooch, with Martiniere, with La Motte, with Bordenhave, with Percy, and Cannac, you will readily lend your aid

in rescuing and in preserving their names, their merits, and the truths they have uttered, from being buried and lost, beneath the lumber of the thousand volumes, which a prolific and undiscriminating press is now heaping upon them.

And now, gentlemen, let me congratulate you on the return of this our anniversary; on the high attainments of the profession throughout our happy land; on the manner in which these attainments are appreciated and requited by a liberal and enlightened public; on the joy we feel in knowing, that every county throughout our extended Commonwealth, is here represented by talents and acquirements, which would do honor to the medical standing of any community. Here, then, let us exchange congratulations. Under the auspices of the gifted author of the dissertation on Self-limited diseases, let us devote a part of the day to social enjoyment, pledging ourselves to each other, with renewed zeal and energy, to continue and increase our efforts in promoting the cause of medical science, philanthropy, and the public good.

Let me remind you, gentlemen, that since our last meeting, sixteen of our number have been removed by death. Let us mingle the tear of sympathy with the friends and kindred of the deceased. Upon us devolve the duties they have so worthily discharged; to us, also, have they left the pleasures, the fleeting pleasures of life. While we enjoy the one, and strive faithfully to discharge the other, let

us acknowledge, appreciate, and honor the virtues they possessed. They have been taken from us; some in the vigor of life, most of them, however, in the maturity of years. They have been stricken from the tree of life, never again, in this world, to be reunited to the parent stock. Yet are they not wholly dead. Dust unto dust. But let us indulge the hope, that what once animated this dust, is now ripening into the rich fruit of infinite existence, knowledge, and happiness.

OBITUARY.

The following members of the Society have died since the last Annual Meeting.

1844.		Entered the Society.	Age.
Oct. 2,	Friedrick Hartmann, Boston,	1842,	30
Nov. 5,	†Joseph Sampson, Brewster,	1817,	60
"	†Isaac Hurd, Concord,	1798,	88
" 24,	†John Bartlett, Roxbury,	1798,	84
Dec. 2,	†Abishai Howard, Sturbridge,	1825,	77
" 13,	Edward Bradstreet, Beverly,	1838,	31
1845.			
Feb. 13,	†Gridley Thaxter, Abington,	1809,	89
Feb. 27,	†Samuel Adams, Cincinnati, Ohio,	1803,	78
Mar.	Joel Burnet, Southborough,	1836,	46
" 9,	†John Scammel, Bellingham,	1811,	83
" 30,	Samuel Young, Harvard,	1813,	64
April,	Edward L. Coffin, Lynn,	1825,	50
"	John Hastings, Hatfield,	1813,	80
"	Stephen H. Wardwell, Hardwick,	1839,	57
May 12,	Benjamin Parker, Bradford,	1810,	85
" 16,	Patrick Kearnay, Boston,	1843,	40

HONORARY MEMBER.

		Elected.	
April 10,	Thomas Sewall, Washington, D. C.	1836,	59

† Retired Members.

CASES

OF

COMPOUND AND COMPLICATED

FRACTURES.*

CASE I.

In the autumn of the year 1831, Benjamin Franklin, son of Mr. Gilbert Haven of Malden, of a scrofulous constitution, aged between five and six years, met with the following severe accident. While playing in a mill, his clothes became entangled in a horizontal axis which formed part of the machinery. By the successive revolutions of this shaft, his apron, arms, and body, were quickly wound about it; in which situation he remained, revolving with great rapidity, until the workmen had time to stop the motion of the mill. When first removed from the shaft, life seemed extinct; but the patient soon showed signs of reviving.

A short time after the accident, I saw him, in consultation with Dr. Buck, whose patient he was. The radius and ulna of the left side were fractured, from the elbow to the wrist, into a great number of small fragments, none of which, however, perforated the skin. The right humerus had sustained a comminuted

* The cases numbered from 1 to 23 serve as a basis for the foregoing essay; and the cases and authorities lettered from A to L illustrate the principles to which they severally refer.

fracture, extending nearly from the elbow to the shoulder-joint; the skin, cellular membrane, and muscles, were so torn and lacerated, as to allow the finger to be passed through the limb in almost any situation, from the head of the humerus to near the elbow; and I can describe the appearance presented in no better language than that used by the workman who came to the patient's aid: he said the limb appeared 'like a skein of coarse yarn,' as he unwound it from the machinery. Notwithstanding the extent and severity of the injury, the trunks of the arteries, veins, and nerves were not divided.

Our first object was to free the wound of loose fragments and shivers of bone. When this was accomplished, we judged that at least half of the entire length of the humerus was taken away. The parts were then brought into apposition, and dressed very lightly. Two tin splints, well padded, and made in the following manner, were made use of: the first, designed for the posterior part of the upper and forearm, was formed of two pieces, united at an obtuse angle by means of solder, and concave transversely; the second, intended for the anterior part of the limb, corresponded to its fellow, except that the concavity was upon the lower, instead of upper side, when applied to the arm. These might be well figured on a large scale, by a portion of common stove-funnel, cut longitudinally, and the pieces bent in their centre at an obtuse angle, their relative position being still maintained.

The left forearm was dressed in the common manner with an external and internal splint. The patient was placed in bed, both arms being supported by slings and resting on soft pillows.

Such was the treatment. This case was attended by no unpleasant symptoms, during the whole course of treatment. In three months, the bone had united, and the soft parts nearly healed, so that the patient was allowed to walk about, with his arm in a sling. At this time, he met with a fall, by which the humerus was again fractured. The same treatment was resorted to, but the wound did not heal until nearly eight months from the original injury, and after about half an inch of the entire shaft of the humerus had exfoliated. At the end of this time, the arm was but little shorter than the other. He enjoyed the free use of both

arms until his death, which took place about seven years after the accident.

Note. On showing this manuscript to the parents of this lad, I learned that all his limbs became weak and ulcerated from scrofula for some time before his death, but that the fractured arm was not more affected than the others. In all other particulars they consider the account correct.

W. J. W.

CASE II.

On the twenty-third day of June, 1833, I was called to see, in consultation with Dr. Whittemore, of Brighton, Eliza A., daughter of Stephen Bennett, aged four years, who had just suffered a compound fracture of the humerus, produced by a heavy horse treading on the arm while she lay prostrate on the ground. We found the bone broken transversely across, one and a half inches above the elbow joint. The skin was so lacerated, that the wound extended obliquely nearly round the limb, as there remained entire only a portion, about one and a half inches wide, uniting the integuments of the arm with those of the fore-arm. This portion of skin was situated just in front of the inner condyle. The whole mass of extensor muscles, excepting a small portion near the inner condyle, was divided. The torn skin was stripped down over the elbow some little way; both fragments of the humerus protruded from the back part of the arm, while the bundle of large blood vessels enveloped in their sheaths, and perhaps a little cellular membrane, lay in front entirely insulated from other parts, the distance of about two inches. We first washed and thoroughly cleansed the wound of all foreign substances. We next brought the parts in apposition, as nearly as we could in their natural relation one to the other, and so maintained them by a few points of suture, and the same mechanical means used and described in the case of B. F. Haven. Under the judicious care of Dr. Whittemore, this case was brought to a speedy and happy termination, without the occurrence of any un-

toward symptom. A few months since, I called on this young lady, and found her in the full enjoyment of sound health and a perfect limb. W. J. W.

CASE III.

On the seventh of October, 1839, I was called to see William Tyler, ship-carpenter, residing in Brighton Street, Boston, of large stature, and weighing more than two hundred pounds, who had fallen from a scaffolding to the ground, a distance of twenty-five feet. He alighted in a perfectly erect posture, thereby producing a compound fracture of the left leg. When first seen, there was a large, lacerated wound, about midway between the foot and knee, and, lying across this wound in a transverse position, was a piece of bone which had constituted three inches of the entire shaft of the tibia, but now detached and terminating in ragged angular extremities, which made its length from point to point about five inches. These pointed extremities were deeply imbedded in the soft parts, and the limb being shortened, the broken ends of the upper and lower portions of the tibia crowded and bore upon the transverse fragment, so binding it in its unnatural situation, that considerable extension of the limb was required to enable me to detach and set free one of the pointed extremities. I now found the fragment had strong adhesions with the interosseous ligament and with some muscular structures. These adhesions were carefully divided by the knife, and the fragment happily removed without hemorrhage. The Fibula was broken across near its middle, and its fractured ends could be plainly distinguished, over-lapping each other. There was an appearance of contusion about the wound, and in the cavity of the wound and its neighborhood was considerable infiltration of blood; there had however been but little bleeding.

The dressings for the limb were arranged by spreading out smoothly for a splint-cloth, a piece of stout cotton, four and a half feet long, and in width, the length of the limb. Upon the middle of this were laid, longitudinally, strips of partly-worn cotton, each four inches wide, and in length a circumference and half of the

limb. These strips were placed one upon another; thus, the first and upper, which was to be under the knee, being overlapped one half of its width by the next below, and this in like manner by the second, this second by the third, and so on, a sufficient number of strips being used to afford a covering for the whole limb.

The patient was placed upon a bed consisting of two hair matresses, one lying upon the other, made perfectly even and horizontal; and under the head was a single pillow. The leg having been shaved, and all foreign matters removed, the wound was filled with pledgets of lint smeared with mild ointment, and the limb then laid upon a pillow, having spread out on its upper surface the dressings already arranged. The strips of cotton having been previously moistened with cold water were smoothly applied around the limb; the strip last laid upon the splint-cloth being first brought somewhat loosely around and about the foot and ankle, the ends permitted to cross and thus be retained in place. The remaining strips were similarly adjusted up the course of the leg in succession, till the entire limb was covered, from the foot to the knee. The moistened strips were applied so that they might exert an equable though slight pressure upon every part, without, however, causing swelling of the foot or ankle.

Two splints of soft wood, each six inches wide, one eighth of an inch thick, and of sufficient length to extend from above the knee some way below the foot, had, in the mean time, been prepared, and soaked in warm water to render them pliant. These were next accurately adapted to the limb, by enveloping each, somewhat angularly, in opposite ends of the splint-cloth, and rolling them over therein, till, after several trials, they were at length brought to lie close along the sides of the leg, and produce a slight stretching of the splint-cloth below and between them. Owing to the great size of the calf of the leg, the direction of the splints, when adjusted, was far from parallel; the ends at the foot being much nearer together than those at the knee. Carded cotton was next introduced freely but gently between the splints and limb, to fill up any inequalities there might be between them, and enable the splints to bear and press everywhere alike. The dressings were retained in their proper position by three elastic liga-

tures, each one inch wide, and long enough, when doubled upon itself, to be fastened in a bow-tie, after passing entirely around the limb and its investments. One of these ligatures was just below the knee, a second immediately above the ankle, and the third between these two, as high up the leg as possible, without pressing upon the calf.

In the process of cure, the dressings were modified as circumstances seemed to require. There were not, at any time, severe nervous or febrile symptoms. The wound granulated and was filled up without exfoliation of bone or deposit of pus. After the cicatrization was complete, the left leg was found to be two inches shorter than the right. At the end of three months, the patient began to use his limb in moving about, and has recovered with a good leg. W. J. W.

CASE IV.

On the fourth day of May, 1844, I was called in consultation, with Dr. Ephraim Buck, to see James Light,* in Tileston street, Boston — aged twenty-seven years — recently married — by occupation, teamster — accustomed to labor from childhood — of healthy constitution and temperate habits. A heavy block of wrought granite had, an hour or so before, fallen upon the anterior edge of the tibia of the left leg, immediately above the ankle, while the calf of the leg rested upon the flat surface of another stone. The falling stone had struck the leg by one of its square angles, and made an opening, commencing at the instep, and extending upward fully six inches, and its width was about the same. Nearly an inch below the surface, at the bottom of this opening, was a mass of bony fragments, once constituting a part of the entire shaft of the tibia, and forming full three inches of its length. The soft parts, not divided by the accident, were so much contused and flattened, that when viewed from either side, the limb had the appearance of being nearly severed asunder.

* This patient was seen and examined by the Fellows of the Society at their Annual Meeting.

To determine if it would be justifiable to attempt to save the limb, we began by removing from the wound all the loose fragments of bone above mentioned, using our fingers, forceps, or the knife, as might be necessary, being always very careful to keep the edge of the knife close upon the bony structures; in this manner clearing the wound of thirty-eight pieces of bone, and other foreign substances. Having thus obtained abundance of room, we made an examination of the several tissues, to ascertain how much each of them was injured, and to estimate the probability of their being restored to health.

Our attention was, in the first place, directed to what now remained of the bones of the leg. The lower articulating extremity of the tibia, a fragment about half an inch long, and broken short off at its upper end, still retained its natural situation and connections with the astragalus, moving freely upon it, and as there was not any appearance of effused synovia, and no opening into the joint could be detected, we concluded the joint was sound and entire. The superior fragment of the tibia likewise was broken square across at its lower end. The fractured ends of the tibia were at least three inches apart; and it appeared as if the intermediate portion of bone had been removed by violence, yet without great injury having been inflicted upon the bones or soft parts beyond the limits of the wound.

Second, there was sufficient evidence of sensation, in every part, below and about the wound, to convince us that the nerves had not suffered irreparable injury.

Third, about four inches from the lower extremity of the fibula, and opposite its posterior edge, were two small openings through the skin, communicating with the seat of fracture of the fibula—(through these openings, portions of bone, which had escaped our first search, were afterward extracted)—there was but little extravasation of blood, and with the exceptions already stated, the skin and cellular tissue had received less damage than could have been expected.

Fourth, the tendons, though denuded in many places, were not divided, nor extensively lacerated.

Fifth, the circulation in the veins and capillary system was much embarassed, as evinced by the slow return of blood into these vessels when emptied by pressure. The absence of pulsation in the usual track of the anterior tibial artery, and the nature and situation of the wound, led us to conclude that this bloodvessel was divided, although there was but little arterial bleeding. And it may here be well to remark, that as no pulsations of this artery could ever be detected, during the whole course of treatment, our opinion was probably correct.

The following questions now presented themselves for consideration:

First, could the circulation be maintained, and life preserved in parts below so formidable a wound, of such magnitude, situated so very near an important joint, complicated with so great loss of bone, the probable loss of the anterior tibial artery, and the embarrassment in the veins and capillaries necessarily resulting from so great contusion?

Second, would not a wound of this extent and severity, involving so many and important nervous, tendinous, and muscular parts, be very liable to be followed by fatal irritation or erysipelatous fever? and might not profuse suppuration and the ill consequences, usually resulting from the absorption and burrowing of matter, be expected?

Third, even if these dangers should be escaped, would not the tendinous structures so suffer from inflammation as to be united together into one mass with the contiguous parts, and thus lose their control over the foot, and afford the patient merely a useless member?

Fourth, might not the short articulating fragment of the tibia perish from the severe concussion of its ligamentous connections with the astragalus, and a deficient supply of nutrient blood, which now could only be transmitted by the minute vessels? Futhermore, even should life be preserved in this fragment of tibia, would it possess sufficient vital energy to become consolidated by bony union with the superior fragment?

Whether the circulation in the foot would be successfully established, and whether we could support and maintain the foot

in such a position as to prevent gangrene and ulceration, were to us matters of most serious consideration. We had great reliance on the youth, temperance, and health of the patient; we called to mind, also, that there was but slight extravasation of blood into the cellular membrane, notwithstanding the violence of the concussion; and we thought it reasonable to hope and expect, that the lapse of a little time would prove the circulating system to have suffered less damage than was indicated by present appearances. Again, observation and experience had taught us, that, when excessively severe nervous symptoms had occurred after a compound fracture, and especially when near a large joint, the external wound had almost always been small; the sharp points of the bones having merely passed through the skin and fasciae, or else had been driven in among the membranous parts. We had observed, also, that fever of various species had most frequently occurred in cases of this peculiar description, arising probably from similar causes of mechanical irritation, or by matter pent up by membranous structures, burrowing deeply within the limb.

Having thus considered the case in all its various aspects, we concluded to attempt to preserve the limb, having great confidence in the habits and constitution of the patient, and being assured of cordial cooperation both by himself and friends in whatever means might be thought of use in the management of the case. Having made a counter opening aside of the tendo Achillis, and placed a seton therein to prevent its too early healing, the patient was laid upon a bed composed of two matresses, each filled with very soft straw, placed one above the other, and made as smooth as possible. In length, the matresses reached eighteen inches below the foot, and their width was just sufficient for a single person to lie comfortably. One pillow, only, was allowed for the head; and a pillow, covered by a folded sheet, was placed to receive the wounded limb. The leg, having been well shaved, was laid upon the calf and heel, without splint or bandage of any kind. The foot was supported and kept in its proper position by a frame of wood, consisting of three pieces of common pine board, each eight inches wide; the first of these pieces, having

its upper end opposite the inside of the knee, reached downward close to, and in the direction of the leg, below the foot ten inches, where it was joined at right angles to the second piece, which was ten inches long; and this second was united with the third piece, which extended upward, parallel with the first piece, outside the leg and body, as far as the axilla. Bolsters, of suitable size and softness, were placed along each side of the leg and foot, so as to give a steady and secure bearing upon the frame, without, however, causing constriction of the limb. To lessen the chance of hemorrhage, and to be able to control it readily, if it should occur, we thought best not to apply dressings of any sort to the wound. During the first ten days, there was neither great pain, inflammation, nor fever. The foot and ankle were somewhat swollen, and moderately warm; but darker in color than natural. In due time, suppuration was established, and granulations began to show themselves. The wound was then dressed with lint spread with mild ointment, and the greatest care was taken to preserve cleanliness, and to procure a prompt and entire discharge of matter from all parts of the wound. As the granulations increased, the swelling of the leg and foot subsided, and the size of the wound diminished rapidly, the ends of the bones being brought nearer together by the contraction of the muscles.

The immediate care and supervision of this interesting case devolved, principally, upon Dr. Buck and his son; and to their untiring attentions and judicious management, I chiefly attribute its successful result. But notwithstanding their exertions, an eschar formed on the heel, doubtless in consequence of imperfect circulation; and great troubles seemed impending; these, however, were obviated by mechanical means ingeniously contrived, whereby the weight of the foot was transferred, temporarily, from the heel to other parts.

During the first week, the patient was purged daily. His nutriment consisted of gruel, toast-water, and other diluent drinks: ten or twelve days afterward, a generous diet was allowed. No exfoliation took place, though several loose splinters of bone were discharged through the skin even after the closure of the principal wound.

The injured limb now is well formed; two and a half inches shorter than its fellow, and is slightly bent forward at the place of fracture. The position and direction of the toes are in every respect natural. The ankle is free from stiffness, and James Light has as serviceable a leg as is usually obtained after a compound fracture. At the end of eight months, he could walk two miles at a time, without being tired. He wears a shoe with a high heel, and in less than a year, recommenced his labors as a teamster, and is now able to perform a good day's work in this capacity. W. J. W.

CASE V.

As a steamboat approached her landing place, on the eighteenth of July, 1844, she struck, with great force, against the leg of David Pulsifer, junior,* a lad nine years old, who was heedlessly sitting on the pier of the wharf, with his feet hanging down over the water. Soon after the accident, I saw him in company with Dr. John Ware, at his father's house in Salem Street, Boston. The patient was in great pain, and had much constitutional disturbance and nervous excitement. The tibia and fibula were both broken midway from the foot to the knee, and their fractured ends projected forward, forming an angle of nearly 140°. The periosteum was wanting on the front of the broken bones, a distance of three quarters of an inch from the fracture. A small portion of tibia was missing. All the extensor muscles, except part of those arising from the interosseous ligament, were severed as if cut by a dull knife, their truncated ends lying about two inches apart. The skin, cellular membrane, and fasciae, were abraded and gone from a surface, the upper margin of which was along the head of the tibia from the inner hamstring to the insertion of the ligament of the patella; from this point, the outward margin reached to the edge of the fibula opposite the fracture. The inferior margin extended across the limb, anteriorly

* This patient was seen and examined by the Fellows of the Society at their Annual Meeting.

downward, to the anterior edge of the tibia, about two inches below the fracture, and thence posteriorly, upward, to a point in the calf of the leg opposite the fracture. And it may here be remarked, that the entire width of sound skin, on the back of the leg in this region, did not exceed one and a half inches. The remaining margin, on the inside of the limb, was from the point already spoken of in the calf of the leg to the inner hamstring. The fingers could be passed behind the broken bones, between them and the muscles.

As the boat rebounded from the wharf, a piece of flesh was seen to drop into the water; yet, owing to the retraction of the skin, the loss of integuments was probably less than the apparent wound. At this time, no pulsation could be discovered in the course, either of the anterior or posterior fibial artery. The leg and foot retained some power of feeling, but were cold to the touch.

Under these circumstances, it was agreed to put the patient in bed, to draw the leg out strait, placing it on its outer side, upon a soft pillow, and then wait awhile to ascertain how far the circulation of blood would be reestablished. At the end of five hours, we had the pleasure of finding our patient more free from pain, his foot and leg warm, and both tibial arteries pulsating distinctly. We now determined to attempt to save the limb, being encouraged by the following considerations.

First, although the limb perhaps was more than half divided, yet the trunks of the most important arteries, veins, and nerves were unhurt.

Second, although the integuments appeared lost over so large a surface, nevertheless we had but little doubt that the actual loss of skin was less than it seemed to be; and further, that a sufficiency of skin might be borrowed from the neighboring parts to almost cover the wound.

Third, such was the nature and extent of the wound, that there was no danger of the lodgment of matter and its consequences.

Fourth, as the joints and tendons were uninjured, we had good reason to believe that, if the patient could survive the first shock, and reunion of the bones should take place, he would obtain a useful leg.

Fifth, the season of the year and the locality of the patient promised to afford all the advantages of pure air, ventilation, and quiet. Besides, his parents and friends possessed the desirable intelligence, firmness, and devotion, to ensure perfect coöperation in nursing and executing any proposed measures.

Having decided upon our course, two hair matresses of convenient thickness were so laid, one above the other, on the sacking of a bedstead, that a horizontal and even surface was afforded for the body. That part of the upper matress, which was to receive the leg, was then raised from the under, the height of ten inches, by inserting pillows between them, so as to yield an elevated, smooth, and level surface for the limb. The bed-clothes were so arranged that they might easily be adjusted or removed, and were carefully guarded to protect them from any foul discharges. The patient was now put in the bed thus prepared, the leg was laid partly upon its outer side and partly upon the heel. A small bolster was placed under the outside of the foot, for the purpose of retaining the natural direction of the foot with the knee. Other soft and elastic substances were so arranged along the leg, that the weight might be equally distributed.

The wound was lightly covered with lint, smeared with resinous ointment.

The diet was toast water, gruel, and lemonade; no anodyne was given. A strenuous attempt was made, for two days, to evacuate the bowels, first by Rochelle salts, in small doses, and then by castor oil; but without success. On the third day, enemata were resorted to, and were very effectual, bringing away copious natural discharges; and ever afterward during the treatment, enemata proved sufficient to empty the bowels. The limb continued to be remarkably comfortable; the foot warm, and its arteries pulsating naturally. Two or three days after the accident, the patient found he could move his toes somewhat, and was much pleased. His thirst was not great, his tongue was but slightly coated, his skin of satisfactory warmth and moisture, his sleep sufficient and refreshing. On the seventh day, suppuration was established over all the soft parts; there was not any sloughing, and but moderate swelling of the foot or leg below the fracture.

The fibres of the gastrocnemius and soleus, which had been violently contused, gave evidence of adequate circulation and healthy action. He was now permitted to take bread and butter, which had been his favorite food and chief nourishment from infancy; he also had a little ripe fruit, and now and then, but seldom, he was induced to eat some of the breast of a broiled chicken.

The dressing of lint, smeared with resinous ointment, was continued for about twenty days. The greatest care was always taken to remove, daily, all matter which had been discharged, and to maintain the most scrupulous cleanliness with the least possible disturbance of the limb.

At the end of three weeks, granulations were seen arising from the fractured extremities of the bones, and covering, also, the entire surface of the wound, which was fast filling up and losing its hollow and disconnected appearance, as cicatrization had commenced on the inner and upper part of the calf, the skin having grown down, and adhesion taken place between the deep seated structures on the posterior part of the leg. From this time, narrow strips of linen, spread with Turner's cerate, were applied upon the margin of the wound, and the whole wound was filled with abundance of lint to absorb and imbibe all discharges.

The patient had always made great complaint, whenever the dressings were changed. Although handled with the utmost care and tenderness, he occasionally would cry out, saying he had acute pain shooting through the head; yet shortly afterward he would become cheerful, and remark that he had not suffered much, but feared that he should. He went on in this way, improving fast, till about the middle of August, when, one day, on removing the dressings, the muscles originally severed appeared covered with striae of dark blood, seeming as if pressed out from the minute veins. The appetite and strength were less; but in other respects there was no change. The next day, the wound had become of a deep purple over the whole surface. The granulations were puffy, and discharged unhealthy sanious fluid. The leg and foot were cold and deep colored. He had nausea,

coldness of the skin, severe shooting pains in the ankle, alternating with similar pains in the head, which caused sudden and violent outcries. In the night he was delirious. On the third day there were small, frequent, and slimy stools with great tenesmus; the discharge from the wound, however, was less, and of better quality. The appearance of the granulations, also, was somewhat improved, especially in color. The foot and leg were warmer, but a little swollen. Upon the part of the wound, immediately over the upper end of the lower fragment of the tibia, was an elevated red border, which daily became more and more developed, gradually traveling downward over the leg, ankle, and foot, followed by slight desquamation. While this was going on, the whole foot, but especially the region near the ankle, was exquisitely tender and sensitive. The diarrhœa and other severe symptoms all passed away in about sixteen days, leaving the patient emaciated and debilitated, with one small sloughy sore on the outer ankle, and another over the head of the fibula. While appearances were adverse and threatening, the limb was carefully lifted daily, or every second day, to allow all discharges to be removed, and the limb to be perfectly cleansed. On the under surface a coating of linen, well spread with Turner's cerate, was applied, and underneath all was placed a piece of very fine oiled silk, and the whole limb then laid upon a soft thin pillow of carded cotton.

When the patient first seemed to be losing ground, wine and sulphate of quinine were administered. On the second day he took six grains of ipecac, which operated upward and downward, causing him to seem better; the next day the wine and quinine were resumed with apparent benefit, but the state of the bowels soon made a change necessary. Six grains of blue pill, to be followed at the end of six hours with six grains of ipecac, were therefore ordered. After the operation of these remedies, as the stools still continued frequent and unnatural, laudanum was given in small doses. I soon became convinced, that the patient had received benefit, only from the blue pill and ipecac, and, that the other remedies afforded merely a temporary and fallacious relief. The treatment, therefore, for some days, notwithstanding the de-

bility and the state of the limb, was restricted to the cautious use of evacuants; by persevering with them, every thing alarming disappeared, about the first of September. The appetite of our patient, then being restored, he consented, by entreaty, to take wine and meat; the wine was soon abandoned; but meat was grateful to him, and he ate of it freely till his strength returned: he has since, however, renounced meat, and gone back to his first love, bread and butter, which he thinks the proper food for him, if not for all men.

While the local symptoms were unfavorable, there was more or less delirium every night, and the last two days, on which stimulants were administered, there was a disposition to sleep, the head being bent backward, besides having at times some lateral motions. There was considerable thirst, but the tongue was never dry nor parched, its appearance being deceptive, and seeming to indicate treatment different from that which experience proved to be correct. The pulse was always frequent, having a range of beating from 110 to 140 strokes each minute. The feel of the pulse was not bad, except while the diarrhœa existed; it was urgent, and at times so peculiarly so, that the incautious might have considered it evidence of inflammation or fever. I doubt not, however, that this peculiar pulse indicated a salutary effort of nature to carry on the circulation, in parts so extensively and severely injured.

The simple means, already described, for equalizing the bearing of the limb, and for retaining the foot in its natural position, fulfilled every desired purpose, throughout the whole process of cure; there never having been occasion to employ splints, bandages, ligatures, or apparatus of any other kind.

A small exfoliation from the anterior surface of the upper fragment of the tibia, took place in sixty days, and at the end of four months, there was a somewhat larger exfoliation from the lower fragment. At this time, the bones were somewhat firmly united, and the skin was so drawn down from above and about the knee, and up from the leg, as to leave a cicatrix almost incredibly small, considering the great loss of substance and the original magnitude of the wound. There was but little stiffness

about the joints. The toe pointed downward scarcely any, if at all. The leg was of its proper length, the foot had its natural direction and position, and with the exception of a deep and large cavity, from loss of substance and other obvious causes, was fast regaining its wonted power. At the present time, July first, 1845, the wound is entirely healed, and, with the aid of a small stick, he walks well, with but little limping. W. J. W.

CASE VI.

On the fifth of May, 1843, a rail having become loose, upon the viaduct of the Charlestown Branch Rail Road, over Charles River, a train composed of an engine, a tender, and a passenger car, while passing at a rapid rate across the viaduct, was thrown from the track, and precipitated to the bed of the river below, a distance of fifteen feet, the tide then being nearly out. The tender, which had been stationed between the engine and car, was thrown from its position, and afterward found in the rear of the car, having entirely unroofed, and nearly demolished it in the downfall. Among the sufferers from this accident, was David Chambers,* aged twenty-three years, a man of temperate habits and sound constitution, employed on the road as a conductor, who, at the time of the mishap, was attempting to pass from the car forward to the engine.

I was soon called to him, and found his countenance pallid and hippocratic, his skin covered with a cold sweat, his pulse small, irregular, and intermitting, occasionally it was imperceptible. He had frequent sighings, and jactitation of the upper extremities. Nausea was almost constant, always much aggravated by motion, or slight pressure upon the abdomen, either of which would induce vomiting. He was unable to stand, or to use his lower limbs. He said 'he had received a fatal wound, his back was broken, and he felt something that had been broken, swashing about within his belly.'

* This patient was seen and examined by the Fellows of the Society at their annual meeting.

arose from his bed and walked a few steps. The right lower limb was now found to be an inch and a half longer than the left, when he stood erect, and two and a half inches longer, when sitting down with the legs at right angles with the body. At this time, I had the pleasure of presenting him to the notice of many gentlemen of our profession, who visited him and examined him carefully.

In fifty-five days from the injury, he was able to perform a day's work on the Road, and soon afterward he regularly performed all his former customary duties. In walking, he evidently raises himself higher as he bears on the right limb, than when on the left. He has his natural activity, is free from pain, can walk as far as ever, and does not know that he is, in any respect, worse off for the accident. W. J. W.

CASE VII.

Cambridge, July 12th, 1845.

My dear sir:

Samuel Akerman, aged seventeen, in the afternoon of June tenth, 1845, while directing the reeling of a small rope upon a reel, driven by a steam engine, was caught by the foot, the rope passing just over the instep and drawing him instantly up to the shaft with which the reel turned. He made one complete turn around the shaft, his foot remaining fixed, and then fell to the ground. On visiting him, the left fibula was found broken in its lower third, and the tibia broken nearly transversely one and a half inches above the ankle, the upper fragment piercing the integument on the inside of the Tendo Achillis, and projecting between two and three inches. The posterior tibial nerve, artery, and accompanying veins were broken across, the artery projecting from the wound at each pulsation. There was a small wound five inches above the ankle over the tibia, and the skin, between this and the larger wound, separated from the parts beneath.

There was little bleeding, none from the artery which was contracted for one third of an inch from its torn extremity. The anterior tibial artery was felt pulsating upon the dorsum of the foot. It was determined to reduce the bone immediately. A piece of pasteboard was passed between the bone and skin, and, with the assistance of my friend, Dr. Chaplin, three fourths of an inch of the projecting tibia removed by the saw. The bone was then, with slight extension, readily reduced. The patient was soon after seen by Dr. W. J. Walker, who concurred with us in the propriety of endeavoring to save the foot, and advised that free incisions be made in the fascia and integuments both above and below the wound. During the following night, he slept four hours. In the morning, he was removed to a quiet, well ventilated room, and laid upon a firm matress, with a soft cushion for the reception of the limb. An incision, between two and a half and three inches in extent, was made from the wound upward along the tendo Achillis, dividing the integuments and fascia, which last was found quite tense; a similar incision was carried downward, but of less extent. The foot was then placed upon the heel and covered with a moist cloth; this was the only dressing. During the day, his pulse was 90, full, but not hard. A dose of castor oil produced three dejections. During the three following days, he was restless, and at times delirious, but his pulse was seldom above 100; his foot was warm and of a good color. On the fifth day, he became more comfortable, took his gruel with relish; had much less pain, and the discharge from the wound was free, exceedingly offensive and bloody. On the seventh, the swelling of the foot had begun to subside; the sloughs on the dorsum of the foot, occasioned by the rope, were beginning to separate, and the wound was filling up with healthy granulations. On the thirteenth day, it was found necessary to lay the limb upon its side, on account of a commencing slough on the heel. On the twenty-fourth day, sufficient firmness existed in the fractured parts to enable the patient to raise his limb from the bed. From that time to the present, the cure has progressed rapidly, and the wounds are fast diminishing in extent. There is every reason to

believe he will be well in due time, with a limb but very little shortened.* I am, dear sir, with great respect, your friend and pupil, M. Wyman.

CASE VIII.

Halifax in Nova Scotia, June the 12th, 1768.

Dear Sir,

The pleasure of your acquaintance in London, and the advantages since received by your publication, make me heartily congratulate you upon the reception it very deservedly meets with in the world; and, having an opportunity of writing by a ship going to England, I could not forbear transmitting an account of the success I have had lately in a very bad compound fracture of the leg, by pursuing your method, believing such communication must necessarily prove agreeable to you.

A soldier, aged about thirty, received this accident last January. I was called to him immediately and found it necessary *to dilate the wound and saw off between two and three inches of the whole substance of the Tibia much fractured, and the Fibula was fractured obliquely above two inches below the fracture of the Tibia.*

The wound was dressed as you direct in your Observations; the whole limb was wrapped up in a poultice extended upon a

* I take great pleasure in inserting the above interesting case, treated by my young friend, Dr. Wyman. It illustrates, first, the value of draining the wound from the beginning, second, of shortening the bone, so as to prevent tension in the direction of the length of the limb, third, of prompt and ample divisions of membranous and other soft parts, so as to prevent swelling and tension in the circumference of the limb, fourth, in connexion with the cases lettered D. and E. it shows that broken bones reunite as readily in compound as in simple fractures, provided all complication be removed. It has been my invariable practice, when my patients would consent, to saw off a portion of any bone which protruded through the skin in fractures of the limbs. This I have done, not only to facilitate reduction, but to prevent tension, and more easily extract loose portions of bone. Of the great value of this precept, as given by Mr. Gooch, I have no doubt. W. J. W.

pillow, using the tailed bandage and a stiff paper case, with the assistance also of junks in order to keep it straight and more steady.

By the common treatment of the wound, *it was perfectly cicatrized in three months, and now, about five months since the accident, the callus is perfectly ossified, the man in good health, the limb useful and well shaped, and but very little shorter than the other.*

I was very attentive in observing the operation and progress of nature in making good this loss of substance of the bone, and before the exfoliations were cast off from the ends, a portion of the bone being sawn off at each end, granulations appeared like flesh in the intermediate space, gradually becoming bone as you have observed.*

The advantages of this practice evidently appear in its support; the free openings and removal of pointed fragments of the bone at first, prevent irritation of the very sensible membranous parts, whence proceed inflammation and abscesses in consequence thereof; and it was very pleasing to others as well as myself, to observe what little complaint the patient made, and how expeditiously the cure was accomplished.

I am persuaded, were this rational practice general, few limbs would require amputation on account of splintered bone; and happy would it be indeed, did this method prevail universally in the army and navy.† I am, with great respect, dear sir, your much obliged humble servant, CHARLES HALL,

Surgeon to the 14th regiment.

* See my Cases and Remarks in Surgery, Edit. II, page 285 and seq.

† When I dwelt in Norwich, I was called into the country by a surgeon in great business, expressly to assist in an amputation in consequence of an accident of this nature, to whom I proposed and recommended the method here mentioned. He readily assented to it, by which means the limb was saved and made perfectly useful. I am fully convinced of the propriety and utility of this treatment of compound fractures, from an uninterrupted series of success attending it, having never been obliged to amputate a limb on such an occasion.

See my Cases and Remarks in Surgery, Edit. II, concerning compound fractures.—*Gooch. Vol.* 3, *page* 79.

CASE IX.

A commander at sea, fighting valiantly in the midst of the enemy's fleet, had his leg fractured by the fall of his mizzen top mast, it breaking his leg transversely near the ankle, the edge of the bone thrusting out through the skin. *He not suffering the bone then presently to be set while it was warm, afterward when it was swelled and stiff, it did not yield to extension,* but became painful and inflamed.* After some few days, he was brought to *London*, and I was sent to him. He was of an ill habit of body, subject to the gout and dysentery; and the fracture, being accompanied with great defluxion, was not in a condition to admit of extension; therefore, according to *Fallopius* and *Hippocrates*, before cited by me in this treatise, I proposed to his chirurgeon to proceed by lenients to mitigate pain, inflammation, etc., and by bandage to hinder defluxion. Which we did; and his chirurgeon continued that method for a few days, by which the accidents were remitted. When we met again, finding the patient in ease, we took off the dressings, and agreed to make extension and reduce the fracture. The patient was of a dry tough body, and the member yielded difficulty to the stretch. *Upon which consideration, we satisfied ourselves with a moderate extension, doubting that upon a more forcible one, ill accidents might follow*, as an inflammation presently did. We drest it up as a compound fracture; and after some days dressing, a *callus* thrust forth, and united the bones. That *callus* being confirmed and dried, we hastened the exfoliation of the foul bone by a little *Ægyptiacum* and *pulv myrrhæ* dissolved in *Spir Vin*, applied hot upon an armed Probe. Thus the bone was exfoliated and the ulcer cured by the ordinary intentions in such cases. Yet the inward leaning of the bone continued a weakness in the member a long time, as is usual where the fracture hath not been timely or well reduced.—*Wiseman, vol. 2, page 262.*

* Tension in the direction of the length of the limb. See note to case No. 21. W. J. W.

CASE X.

In St. Clement's parish behind the church, some years since, while I was one evening preparing my dressings for the setting of a fractured thigh-bone in a little child, I was hastily fetcht to assist one Mr. Powell, a barber-chirurgeon, in the setting of a fracture of both the focils of the leg in a man about sixty years of age, of a dry tough body. There I met Mr. Tatham, an industrious, knowing chirurgeon. The fracture was oblique, almost *secundum longitudinem*, and the *os tibiæ* or greater focil had shut itself out by the side of the ankle a great length. *We endeavoured by a strong extension to reduce this fractured bone into its place, but it yielded very difficulty to our endeavour: yet we reduced it, and afterwards cleansed the wound of what shivers or pieces of bones we met with, and brought the lips of the wound together by suture, hoping thereby to keep the fractured bone the closer.*

These great fractures with large wounds, and near the joints, are always subject to grievous pain: and this much more, for that the tendons and musculous flesh were sorely torn, and stretcht by the great extension: *so it was not likely to be attended with less mischief than afterwards befell it.** We let him blood that night and gave him an anodyne draught to dispose him to rest. But he slept little, his pain continuing with much disturbance. *A fever also followed, and within two or three days he became delirious, and in the absence of his attendants, got out of his bed; Upon which, the great focil flew out as at first, and the poor man fell down upon the floor as half dead. We were both presently fetcht, and taking off the dressings, we saw the bone distorted, and the lower stitches broken, and the wound of an ill aspect, as it were, tending to mortification: also the bone thrust out so far, that there was no hopes of its being any more reduced by a new extension.* Upon which consideration we resolved to saw off the end of it: and to that purpose having prepared all things ready, we cut off the remaining stitches, and turned the foot on one side towards the small of the leg, thrusting

* See note, in Case No. 21.

the bone more out, the one sawing the end off, whilst the other with a *spatula*, defended the tendinous flesh underneath from being wounded by the saw. *That done, we cleansed the wound from the saw dust, as also from the shivers of little bones, which we had not discovered in our first dressing, they lying pricking the periosteum, between the fractured bones and membranes, by which those sad accidents had been hastened.* The wound thus cleansed, we turned the foot right into its natural place, there being no need of extension; which being done, we scarified the lips of the wound, and washt them *cum spir vini*, with a little Ægyptiac dissolved in it, and applied *to the ends of the bones Pledgits dipt in the same, and prest out.* We also drest the rest of the wound *cum unguent* basilic with a little *ol Terebinth* warm, and applied a mixture of an Emplast Paracels: and *diachalcit* over the wound and parts about, and then compress and bandage over that, as in compound fractures. The great work was how to support the foot now and keep it even with the rest of the leg, there being so great a distance between them without any bone. But we, having placed the leg upon a quilted pillow, laid him again in his bed, and fitted it in a wainscot case, where it was kept steady and equal, and lay conveniently for our daily dressing him. This done, we committed him to the care of his friends to keep him there quiet, and ordered him cordial juleps etc. After some hours, we let him blood again. *From that time his pain lessened, and his fever and other ill symptoms went off as the wound digested.— Wiseman, vol. 2, page* 263.

CASE XI.

A soldier being shot by a musket bullet in the fore part of the arm, near the *Biceps*, it fractured the bone, and passed quite through. I endeavored, by extension, to place the fractured bone even together, but could not. Upon which I dilated the latter orifice by a large incision, according to the rectitude of the mem-

ber, to pull out those fragments of bones which hindered their right coaptation; and, putting my finger into the wound for that purpose, I pulled out a ragged piece of a bullet. Whether it was part of that which had passed through, was the question. Some of the bystanders thought he was shot with a brace of bullets; but I rather think the bullet was torn by the bone, and that this part was it which had made its way through. *However, by this extraction, the main bone was rightly placed, the shivers, with the extraneous bodies, removed, the matter happily discharged by this depending orifice, and the patient was cured by the common intentions of healing these fractured gun-shot wounds. Whereas if I had taken it for granted, that the bullet was passed through, and contented myself in having endeavored the reducing of the fractured bones, and so dressed him up, it had certainly inflamed and gangrened.* This confirms that doctrine in setting of bones, that if any bone will not be placed equally among his fellows, you ought to cut upon it and take it out.—*Wiseman. Vol.* 2, *page* 184.

CASE XII.

In heat of fight at sea, among the many wounded men that were put down into the hold to me, one of them had his right arm extremely shattered, about two fingers' breadth, on the outside, above the elbow, by a great splinter. I ought to have cut off this man's arm presently, but a sudden cry, that our ship was on fire, put me in such disorder, that I rather thought of saving myself than dressing my patients. I hastily clapt a dressing upon the wound, and rolled it up, leaving his arm in his other hand to support it, and endeavored to get up out of the hold as others did, verily believing I should never dress him nor any of them more. But our men bravely quitted themselves of the fire-ship, by cutting the sprit-sail tackle off with their short hatchets, (which they wore during fight sticking in their sashes.) So we were freed of the fire, and by our hoisting up the topsails got clear of our enemy, and I returned

to my work. But I was at a loss what to do with this man, who lay not far off, complaining of his arm. I would have cut it off instantly with a razor, (for, the bone being shattered, there needed no saw;) but the man would not suffer me to meddle with his arm, he crying, it was already dressed.

The fight being over, and we got into the next port, I caused this mariner's bed to be set up so that I might the more easily come to dress him, . . . *then putting my fingers into his wound, I pulled out first a piece of a splinter, an inch thick or thereabouts, more or less, then rags and bones, great and small; I left not the least shiver.* When I had so cleared the wound of all the extraneous bodies and loose bones, I was amazed to feel what a void space there was between the ends of the bones. But I proceeded and cut off the lacerated lips, which were of no use, *and dressed up the ends of the bones with a couple of dossils dipt in Spir Vini* and *Mel Rosar* warm. . . .

The bandage was made with great moderation, and so fastened, that it might be loosened without trouble to the patient. . . . *If it could not have been so put on, I should have foreborn the use of it, the cure of these wounds consisting in the easy dressing and quiet position, without which you will not cure one of them.* . . . But I was not satisfied how the space between the fractured ends of the main bone could be supplied with *callus. My patient was easier than any of my other with fractured wounds.* When it came to my turn to be visited by my brother chirurgeons of our squadron, they did not dislike the wound, nor my way of dressing, (for we being used to see one another's patients, had all much one way of dressing.) But they laughed at the excuse I made for not cutting off his arm, and doubted I should yet be forced to do it. But I kept my patient flat on his back, and that after a while was his greatest pain; for the wound digested, and the tumor was not then considerable. After the wound was well digested, and the bruised flesh separated, I renewed the dressings, etc. etc.

* * * * *

There was in this patient a strong callus filling up the void place of the lost bone at least two inches, with little or no short-

ening of the arm. But the joint of the elbow was so stiff, from the position it lay so long in, that he could not stretch that joint while I knew him, which was until that ship was cast away.—*Wiseman. Vol.* 2, *page* 185.

CASE XIII.

On the seventeenth of March, 1821, John Harper, a fine lad of fourteen years of age, carelessly riding at full trot, was thrown from his horse; as one of his feet hung in the stirrup, the animal took fright, ran away with him at a gallop, till the girth broke and he fell to the ground. On the arrival of Mr. Hagyard, the surgeon at Hunmanby, where the accident happened, he found the right leg dreadfully fractured; the broken ends of bone projecting from a wound of immense extent, and a portion of the tibia detached, which he removed. After placing the bones in contact, Mr. H. sent for my partner, Mr. Travis, and myself, expressing the greatest doubt, 'whether the resources of surgery were competent to save the boy's limb.' We arrived at candle-light, and found the poor lad in a small and wretched hovel, extended on a couch, with a large wound, and destruction of the skin of the middle of the leg; the upper portion of the tibia projecting like a stick, unconnected with any of the soft parts, and deprived even of its periosteum, to the extent of between two and three inches, and the lower portion denuded of all covering to the length of three fourths of an inch. The fibula was also fractured near the knee, and in the centre of the leg, so that it was divided into three pieces. It was, however, so connected with the surrounding parts, that the spiculæ of bone could only be discovered by the insertion of the finger into the wound. The teguments on the posterior part of the limb, although much bruised, were not deadened: and the circulation could be distinctly traced along the course of the posterior tibial artery. A considerable hæmorrhage took place at the moment of the accident, but

was now suppressed. The wound was six inches or more in length, and as many in breadth; but the boy was comparatively tranquil. On consultation, the grand question was whether to amputate the whole member; to put it up in splints as it was; or to saw off the denuded rough extremities of the tibia, and treat it as an ordinary compound fracture. In this dilemma, which required immediate decision, we determined upon the last expedient. The tourniquet was therefore applied, the broken ends of the bone raised from the wound, and while the limb was held steady by one, and a bone knife kept under the exposed portion of tibia by another of my friends, I successfully *amputated the two extremities of the fracture, including about three inches of the whole cylinder of the tibia.* We were unable to reach the fibula with any instrument, so that the two portions of the tibia could not be brought within an inch and a half or two inches of each other, without projecting the spiculæ of the former into the surrounding muscles. One vessel in the bone bled after the operation, but the hæmorrhage instantly stopped on the application of pressure. Stitches were now passed through the edges of the wound, their sides were drawn as nearly together as convenient, strips of adhesive plaster were applied round the limb, with an eighteen tailed bandage and splints. The boy was laid in an extended position, with the leg a little elevated upon a pillow. An opiate was administered, and small doses of Epsom salts prescribed for the morning.

March 18*th. He passed a good night;* pulse about 100; his bowels, after a few spasmodic pains, were relieved; he had a few startings of the limbs in the morning, which soon yielded. A very low diet was enjoined.

On our visit of the twenty-second, we found him so well, and the fever so trifling, that we did not dress the wound. He had used no medicines; *his foot was scarcely swelled; the limb was without pain and steady.* A small opening was made through the dressings to liberate any possible accumulation of pus; diet a little improved. When I visited him on the twenty-fourth, a week from the accident, the discharge and fetor had so increased, that it was judged necessary to remove the dressings. This was a delicate

operation, which we performed as seldom as possible; only a few drops of blood, however, escaped from the disturbance; the stitches were beginning to separate, a large dead piece of skin was detaching, and a sinuous * ulcer broke out above the wound, which discharged a table-spoonful of matter. On account of the trouble of removing the adhesive plaster, strips of lint spread with cerate were now substituted. Our patient went on favorably, with a slight interruption one night, from a change of position. Twenty-sixth, discharge increased, but by no means severe, very healthy:

* * * * * *

April 10*th, the limb much improved.* 14*th, the wound cicatrizing fast. Several small sinuses* broke out on the leg, but to my great satisfaction, on elevating the limb, it felt like a solid bone, without trembling in the centre as formerly.* We began now to strap it with the Emplastrum Plumbi, spread on linen, from the ankle to the knee.

* * * * * *

On the twenty-sixth of October, I made a journey to Hunmanby, when, to my great pleasure, I met the boy in the streets, looking remarkably fat and well, able to walk without crutches, with his limb only an inch shorter than the other.—Mr. Dunn, Medico Chirurg. Transactions. Vol. 12, *page* 167.

CASE XIV.

March 28*th,* 1821, 2 *P. M.* Johnson Turton, aged sixteen, was at work in the ship yard of Messrs. Tindells', when a plank of wood, eighteen feet in length, five in breadth, and half a foot in thickness, was thrown from the ship, which struck the middle of his leg. When Mr. Travis and myself arrived, we found him on a squab, the wound bleeding a little, and the foot turned

* Was not the constriction of the stitches and plasters the true cause of these sinuous ulcers? W. J. W.

inwards. His stocking was now removed, his trowers cut off, the wound washed and examined, and a loose portion of bone taken away with the fingers. Both the tibia and fibula were fractured; the ends of the former protruding from a very long wound, about half the length of his leg, which had the appearance of a clean cut; the ends of the bone were very ragged; *the most forcible extension could not place them in coaptation.* We, therefore, determined to saw off their extremities, with the common amputating saw. The upper portion, as in the former case, was removed first, a steel spatula being placed underneath, and a linen retractor round the bone, to defend the muscles; but the latter was so inconvenient that I threw it away, and depended on our hands. As the lower portion of bone was connected posteriorly with the muscles, the saw was withdrawn when it had gone nearly through, and the operation was completed with the bone forceps. No hæmorrhage followed, of any consequence; the wound was cleaned, the bones put in apposition. About half an inch of the exterior part of the tibia was left denuded of its periosteum, which was considered of no importance, as the rest of its circumference was connected with living parts. The edges of the wound were brought as near together as we could, and retained with three stitches, adhesive straps, and an eighteen tailed bandage. The limb appeared to be very straight, splints were applied and it was placed on a pillow in the extended position. *The boy complained as little as the other during the operation.*

* * * * * *

April 2*d.* The dressings at the lower part of the leg were released with scissors, some discharge oozed underneath. 3*d*, *the limb dressed for the first time, the wound assumed a fine healthy aspect;* nearly two inches of the upper part appeared to be almost healed, only seeming to want the cuticle. 4*th*, *much relieved by being dressed, passed a good night, pulse soft;* to take his ordinary diet, with half a pint of beer per diem. 5*th*, complained of pain on dressing, stitches released, the upper part of the wound, which appeared nearly united, again broke out, and the edges are receding. The edges were much inflamed and injured by the stitches. A medical friend fancied the appearance of his limb so

formidable, and the case likely to be so troublesome, that he said he would have removed the limb at first. *But the pain and inflamed edges seemed to me to have been only the effect of the undue tightness of the suture, arising from the endeavor to bring the edges in contact. 9th,* there seemed to be a sinus running from the fibula. We began to strap the whole limb with diachylon plaster on linen.—*Mr. Dunn, Medico Chirurg. Transactions. Vol.* 12, *page* 167.

CASE XV.

A man, aged nineteen, of a healthy and strong constitution, was on the 15th of August, 1750, wounded by a musket ball, which was fired from so short a distance, that after passing through his thigh and breaking the femur, it struck a woman, who was some distance off, in the foot. It entered his thigh in the lower third of the internal and posterior part, and escaped anteriorly and a little outwardly, just above the condyles of the femur, which was fractured for four fingers' breadth; as the examination of the larger splinters, which I sent to M. Morand, clearly showed.

The patient, being in a state of intoxication, increased the extent of his injury, by the attempts which he made to get up. After having been carried to St. Sauveur hospital, at Lille, his wound was properly dilated and the splinters removed by M. Pollet, head surgeon. The next morning, he suffered from *tension, great swelling, and sharp pains throughout the limb, with great febrile excitement.* Amputation was proposed in consultation, and decided upon as the sole way of obviating the grave symptoms which were to be expected in such a wound; indeed, it was not natural to suppose that union could take place, or that the circulation of the leg below the knee could go on, during so long a treatment as would be necessary, should an attempt be made to save the limb.

The patient, however, being opposed to amputation, it was necessary to wait the result. Some few small splinters were removed,

and an attempt was made to protect the flesh from the sharp corners of others which could not be removed. *The posterior wound was dilated still more at its upper border, in order that the pus might flow freely, and the limb was placed so as to favor this intention, and at the same time, the return of those fluids which obey the laws of circulation.* Notwithstanding these precautions, a number of abscesses were formed at different times; one on the inside of the knee, another on the outside, then a third, in front; none of them, however, seemed to be deep, or to communicate with the joint. *The necessary incisions assisted the escape of the rest of the splinters of bone. The limb was now swelled and gorged with stagnant fluids, so that mortification seemed impending.* Nature even seemed to indicate amputation by a line of separation encircling the limb at the upper border of the wound. The patient was now willing to lose his limb, but the surgeons, called in consultation, did not agree in recommending it. Diarrhœa and slow fever, which soon followed and resisted all remedies for a month, seemed to render it unfortunate that the operation had not been done.

About three months after the accident, an abscess, of considerable size, made its appearance at the upper and inner part of the thigh; another followed on the outside and very high up, which seemed to be under the fascia lata: they were both opened, and the parts properly dilated. Notwithstanding the carelessness of the patient with regard to diet, a healthy suppuration was now established from all the wounds, and perfect cicatrization was accomplished at the end of ten months.* The ends of the femur, drawn together by muscular contraction, united, and became bound together by a very strong callus, by means of which the patient makes use of the limb quite freely, and walks without assistance. The joint is not at all stiff; the thigh is shortened four inches, which corresponds with the quantity of bone lost.

This case seems important on many accounts. The nature and texture of the limb, composed of tendinous parts at the seat of the fracture, which was near to a large joint, and in the vicinity

* See fragment from Ambrose Paré, in appendix, lettered G.

of large blood-vessels, required much care on the part of the surgeon. The great degree of contusion in the course of the wound, the tearing of the fibrous membranes, and especially of the periosteum, the irritation which the sharp points of bone necessarily caused, the general disturbance in the whole limb which such a fracture must produce, were all calculated to inspire fears for the most severe symptoms. Others would also arise afterward from *the strangulation of the limb from swelling*, the suppuration from the wound, and abscesses on the limb, as well as from the effects which the vicinity of the pus to the knee joint might produce. To all these were to be added the danger from diarrhœa and fever. How vast must have been the labors of Nature to bring this wound to perfect cicatrization.—*M. Boucher, Mémoires de l'Académie de Chirurgie. Vol 5, page* 283.

CASE XVI.

I saw in the same hospital, while it was occupied by those officers who fell sick or were wounded in the last war, one of the king's guard recover, without amputation, from a gun shot fracture of the lower end of the humerus. The circumstances of this case were, however, very different from the preceding. Few of those grave symptoms occurred in this case. It must, however, be confessed, that many amputations have been performed from the fear in which surgeons stand of the accidents to which such injuries give rise.—*M. Boucher, Mémoires de l'Académie de Chirurgie. Vol 5, page* 283.

CASE XVII.

On the 23d of October, 1752, a laborer at the plaster quarries, near Ville Juif, had the misfortune to fall to the bottom of them,

a distance of about forty feet, from the breaking of the rope by which he was sustained.

M. Varnier, a skillful surgeon of Ville Juif, was sent for. He found the right leg broken; the tibia not only piercing the skin, but also the gaiter, of the workman.

As soon as the limb was uncovered, it was evident that the fracture was complicated and accompanied with comminution of the bones; and the injury seemed so severe, that after long reflection, M. Varnier thought that amputation offered the only chance of saving the patient's life. To this, however, he would not consent.

M. Varnier then proceeded, after getting ready a proper apparatus, to the reduction. He was, however, first obliged to make an incision on the anterior part of the leg, to reduce the bones which protruded. After this reduction and the proper dressing of the fracture, the patient was bled, and this was repeated four times that very day. The three following days, he was bled six times, from the foot as well as arm, in order to calm the delirium, which, however, lasted ten days.

During this time, it was impossible to keep the parts in position. The foot and leg swelled excessively with phlyctenae. M. Varnier made a number of incisions to oppose the progress of the gangrene. The symptoms being somewhat calmed, M. V. wished again to try reduction; but the swelling was so great that it was found impossible.

I was requested to see the patient on the 11th of November, the 20th day from the accident. I found the limb considerably swelled, and a portion of the tibia bare of periosteum, raised above the level of the skin, and having no other connections than a portion of the interosseous membrane and periosteum.

I removed this portion of bone, taking care to preserve as little as possible of the periosteum; the medulla was already fœtid. At the lower end of the fracture, we found another fragment, totally detached, nine lines in length by three in width. The first piece was five inches, three lines, in length, composing the*

* Query. Had this piece of bone been removed at first, would it not have saved much subsequent trouble? W. J. W.

whole thickness of the tibia. After removing these bones, we pressed out a quantity of sanguinolent matter, which seemed to proceed from the outer and inner sides of the leg.

The posterior part was in a gangrenous condition, from the heel to within three fingers' breadth of the ham. The skin, cellular tissue, and fascia, were mortified to such an extent, that on raising the leg, they fell in shreds. Having removed them, the fracture of the fibula was brought into view, situated near its middle, corresponding with the centre of the cavern left by removing the fragments of the tibia: for more than six fingers' breadth, it was denuded of periosteum, and the extremities overshot each other about four inches.

I thought it my duty not to reduce these bones, until I had thought of an apparatus which would allow me to support this mass of flesh from which so large a quantity of bone had been removed, and dress the posterior part, without deranging the fibula, after I should have reduced it.

Some time ago, M. la Faye presented to the Academy a machine of tinned iron, for the use of the Military Hospitals, intended to facilitate the transport of those who suffer from fractures of the thigh or leg. I took this machine as my model, making certain modifications to suit the present case, of which the most important was, to enable me to dress the posterior part of the leg without undoing the apparatus. With this view, I cut the three posterior sheets of tin, transversely, into three equal parts of two inches each; by which means, I obtained three doors or windows which moved upon hinges, at the part corresponding to the inside of the leg, and could be closed by a sliding pin upon the outside.

After dressing the wound upon the anterior part of the leg, closing the machine, and fastening it by two cords moderately tight, the one at the upper and the other at the lower part, the limb can be raised without fear of disturbance. . . . After raising the limb, and having *prepared* dressings the size of each opening, the *windows* are removed successively, and the dressings introduced, leaving but a small portion of the leg at any one time unsupported.

Every thing being thus prepared, we reduced the fibula, placed the limb in the apparatus, and dressed it in the way just described.

Before this, the patient was in great pain; and notwithstanding the strict diet which was enforced, was troubled with loss of sleep and continual fever, which put his life in danger, although he was of a strong and vigorous constitution, and only about twenty-nine years of age. The reduction, however, improved his condition at once, so that the first night he slept four or five hours: the suppuration diminished daily. The wound was dressed with dry lint; the ends of the fibula, and of the tibia, which last was granulating well, were dressed with dossils dipped in oil of turpentine. No exfoliation occurred from these bones.

Every thing went on well until the 8th of December, when the portion of the fibula which had lost its natural color, some days before, separated into a number of pieces, the largest of which was an inch in length. M. Varnier informed me of this; I found the muscles so contracted, that the limb was shortened about four inches, and, of course, considerably augmented in thickness.

On examining the extremities of these bones, I found that there was not sufficient extent of surface to maintain them against each other. We therefore tried no longer to reduce it, *but I endeavored to find a way to keep up permanent extension, as the patient could not remain in this condition, on account of the great pain produced by the pricking of the ends of bone which stuck into the flesh.* To accomplish this, I drove into the earth the end of a plank, four feet in length by one in width, and two inches in thickness, for the patient was in a cellar. This was supported by nails driven into the lower horizontal bar of the bed. I cut out a portion of the upper part of this plank, four inches wide and eighteen long, which left me two perpendicular bars, in which I bored holes an inch apart up and down, for a use that shall be mentioned presently.

I had previously had a wheel made about four inches in diameter, pierced in its circumference by a number of holes, half an inch from each other. Another hole was made in the centre to receive a cylindrical axis, a foot in length and an inch in diameter,

cut square at the end opposite the wheel, to which a handle was to be fitted to turn it.

I then endeavored to make counter extension by means of bands, some of which were passed under the axilla, others in the groin of the fractured side, and others to the knee, all well padded and fastened to the head of the bed. I then placed a very thick compress around the leg, just above the malleoli, and over it a band of strong thread ribbon, [*quality binding*,] the two ends of which were nailed to the axis of the wheel just described. It is evident that when the axis is turned by means of its handle, this extending band must be rolled round it, to any desirable extent. When this is accomplished, the wheel is stopped by means of a pin passed through one of the holes in its circumference, while the axis is sustained by pegs, placed at discretion, in the holes made in the plank.

At our first trial of this apparatus, the limb was lengthened two inches, without any inconvenience to the patient, but on the contrary, his pain was diminished.

For a number of days, care was taken to turn the wheel several times, so as to gain a few holes only: in this way, the limb regained its natural length.*

To relieve the patient from the pain of the counter-extending bands, I placed another plank at the foot of his bed, with a kind of rest, against which he could press with his sound foot. This added much to his comfort.

* * * * * *

The wound, caused by the protrusion of the tibia, was entirely healed the 20th of January, (1753.) Some portions of bone exfoliated after this from the fibula. We had, however, the satisfaction to see it covered by healthy granulations on the 2d of February, and the posterior wound wholly cicatrized the 1st of March. *I then observed that a substance of moderate solidity might be felt between the two ends of the tibia, in the hollow left by the portion removed, particularly on the internal side where the periosteum was least removed.*

* See Fragment translated from La Motte, annexed, lettered K.

* * * * * *

This substance has increased and become so solid that the patient can move his leg from side to side. I have not yet, however, allowed him to bear his weight upon it without the assistance of crutches. M. M. Chapillon and Bertrand are witnesses of the truth of what I have asserted.— *M. Coutavoz. Mémoires de L'Académie de Chirurgie, vol.* 6, *page* 23.

CASE XVIII.

An officer, at the siege of Douai, A. D. 1710, received a wound from a small shell, (Obus) on the outer and middle portion of the leg, four inches long and two wide, shattering the bones of the leg and foot. In an ineffectual effort to rise, he so displaced the broken bones, that the foot became everted and the leg turned inward. 'On seeing him soon after,' says M. Cannac, 'I was truly astonished at the violence which both the leg and foot had suffered; and seeing the extent to which the bones were shattered, without however injuring the bloodvessels, I considered amputation the only means of preserving life. The patient requested me to remove a large portion of the tibia, which protruded from the upper angle of the wound and greatly annoyed him by its points. As I arrived at midnight, I deferred amputation until morning, to have the benefit of a consultation; yet to gratify the patient, I applied a tourniquet and removed the obnoxious fragment. To accomplish this, I had to extend my incisions far up the leg. Having removed the large fragment, I found many smaller pieces lying loose behind it, and took them away. *The patient was greatly relieved by what I had done, yet soon after, the leg and foot, below the wound, began to swell so much, that I determined to make deep incisions therein*, having no fears, as the leg was destined to amputation. *In consultation, amputation was unanimously agreed upon*, but this advice was overruled by the patient and his brothers. Suppuration came on in five days. In six, the town capitu-

lated. *This officer, after a long time, recovered with a straight leg, only two inches shorter than its fellow, notwithstanding the injury he received in being conveyed to Cambrai immediately after the capitulation.—M. Cannac, Mémoires de l'Académie de Chirurgie. Vol.* 6, *page* 174.

CASE XIX.

In the month of August, 1694, I was called to St. Croix to see a farmer, who had fallen under his wagon, the wheel of which had passed over his left leg, breaking both bones and causing a wound in the middle, which nearly encircled the limb, leaving only about two fingers' breadth of sound integuments. So great was the contusion of the muscles, that there seemed hardly room to hope that the limb could be restored. I got ready however my apparatus, which consisted of dossils of dry lint, strips of linen folded, 18 tailed bandage, splints, long compresses,* and a roller, to be applied in the form of the figure 8, to the foot and lower part of the leg.

Having made his bed, I had him placed upon it by one of my apprentices, while I myself supported the leg.

I now arranged the limb in such a manner, that the foot was about four inches higher than the knee.

Two assistants, without raising the limb from the pillow, made extension and counter extension, while with my hands I pushed the extremities of the bones, in order that they might reassume their proper relation: this was easily done, and easier to be seen, the bones being entirely uncovered. *In reducing them, I neglected none of those important points which should always be observed in the reduction of a fracture. This was proved by the cessation of pain, which, up to that time, had been excessive;* by the straight line presented by the edge of the tibia, the more perceptible

* '*Compresses Longuettes.*'—These are formed of a piece of linen, the length of the limb, and about three inches wide, when folded four times.

from this bone being bare; and finally, by the proper relation existing between the knee and great toe.

The fact that the tibia was uncovered, rendered any comparison of this leg with the sound one unnecessary, as the ends of the bone were seen to be in apposition, end for end.

I dressed the wound, including the portion of bone uncovered, with dossils of lint dipped in brandy; the compresses were also moistened with it; and the 18 tailed bandage in rough wine.

Two entire months passed without any change in the limb, during which time, M. Doucet saw the patient a number of times, and urged me, continually, to amputate it, since it was in such a bad condition and excessively tumified: the suppuration, also, was great, and the fragments of bone, which seemed about to separate, quite large.

But, as the man was strong and vigorous, and had good courage, the benefit of country air, and the season was favorable, I persisted, and did not despair of healing the fracture, notwithstanding the bad symptoms, although I confessed that many months, without determining their number, would be requisite.

After two months, I pulled away the whole of the inferior end of the tibia, which extended to within about two fingers' breadth of the ankle joint:* the fragment was four fingers' breadth long, and comprised the whole thickness of the bone with the medullary canal: a large cavern was left in its place. Fortunately, the fibula had united without any perceptible exfoliation. This was, therefore, a great assistance to the patient, as it acted like a splint, and kept the leg of its proper length.

After the separation of the fragment, I dressed the wound only once in three days, instead of every day, as I had before done, the bandages being still moistened with brandy: and nothing wearied by the length of time during which I dressed it, I continued my attendance on it until it was happily cured. *The callus which formed in place of the bone removed, was so strong and firm, that this man walked with ease, and without the slightest lameness:* but this was only after a year of careful dressing, which I

* Had a portion of bone been sawed off, so as to have somewhat shortened the leg, is it not probable much might have been gained by it? W. J. W.

practiced daily, for two months, then every three days, and gradually less frequently; until after a while, the patient did it himself, during which time I called to see him only at my leisure.—*M. de La Motte—Traité Complet de Chirurgie. Vol.* 2, *page* 575.

CASE XX.

Some time after the cure of the last mentioned patient, M. Des Rosiers, and I, had a fracture to treat nearly similar, and produced in the same manner. The patient was a farmer of the parish of Magneville. We carried him to Valogne, that we might attend him more conveniently.

The fracture of the tibia was double. The superior, at the commencement of the upper third of the tibia; the inferior, at the junction of the middle and lower third. *The fragment, thus separated, was five or six inches in length. There were no splinters, and the wound in the soft parts was sufficiently extensive to allow us to see this portion of bone completely bare. So great was the degree of laceration and contusion, that we determined, after proper reflection, to divide with the scalpel the membranous parts which united this portion of bone, thus separated, from the rest of the tibia, and remove it entirely, rather than leave it to be thrown off by suppuration, which would have required a long time, and have much retarded the formation of callus, which we were confident would commence as soon as this obstacle should be removed. That this occurred was perceptible to the eye, as soon as suppuration was freely established.*

In this manner, the limb, which we looked upon as affected with a most severe and terrible fracture, grew strong, daily, so that, after seven or eight months of dressing, the wound cicatrized, and the tibia united by the aid of a good and strong callus, which was formed in place of the bone which we had removed: nor was this leg, so dangerously wounded, different from its fellow, either in thickness or length: to this effect, the union of the

fibula, which took place in thirty days, was of great assistance. This union kept the leg of its proper length and shape: this good result would not have occurred, if both bones had lost an equal portion of their substance; since, in this case, nothing could have prevented the ends of the bones from drawing together, which, without doubt, the muscular contractions would have caused. In a case * of this kind, amputation would be the appropriate remedy, since the limb would be useless to the patient from its shortening, and, indeed, an incumbrance to him. *Neither of these patients, however, for the reason that I assign, have been rendered lame, nor have they suffered the slightest inconvenience from the injury of which they have been cured. — M. de La Motte. Vol. 2, page* 579.

CASE XXI.

In the month of February, 1709, M. Des Rosiers and myself were called to see a young man in the parish of Ivetot, who had received a fracture of the lower end of the right leg, two inches above the joint. So extensive was the wound, that the ends of both bones projected two inches, or thereabouts. *After putting him to bed, we endeavored, at first, to reduce the extremities of the bones, which was one of the most difficult undertakings we ever tried:* † *not only on account of the great force we were obliged to use, but for the fear of tearing away the foot, so small was the quantity of integuments remaining, and so weak did their connection seem. Indeed, M. Des Rosiers repeatedly called on me to*

* The case treated by Coutavoz, No. 17, shows, that the case here described, might have been remedied by perpetual extension. See, also, fragment from La Motte, Letter K. W. J. W.

† *Note by Sabatier.* It seems as if a part of the difficulties, which were presented in this case, would have been avoided, if the wound had been dilated. This omission may be noticed in all the cases of Complicated Fractures mentioned in this work, where the bone protruded. Incisions practiced on such occasions, have not only the advantage of rendering reduction more easy, but they facilitate resolution in the part, and give it a more favorable appearance.

moderate my extension. We succeeded, finally, by means of an elevator, which we used like a lever; and by pressing the end against one extremity of the tibia, the other was sufficiently separated to be replaced.* Without this assistance we should never have succeeded, so much had the tendons and muscles shortened the limb, during the seven or eight hours since it was fractured.

* * * * * *

In this manner we dressed this large wound, hoping that these anodyne remedies, which were also emollient and discutient, would relax *the muscles and tendons, which were much swelled, and tense.* Such was their effect, that after four or five days, there remained no tension, *but the fever coming on the seventh or eighth day, the pains increasing, and the whole limb being swelled and excessively inflamed,* we made use of a discutient and resolvent poultice, applied to the whole leg. The bandages were moistened with wine.

These means, far from fulfilling our wishes in discussing the humor, caused it to fix itself in several places, *where abcesses of some size formed: one was situated at the middle and inner side of the leg, and another at the upper and outer part.* These we opened at the proper time, and they suppurated freely, and for a long time, before they cicatrized.

What was very extraordinary, the fractured side became completely paralytic, from the head to the foot, the other side became convulsed. We were in hopes that the long continued suppuration might cure this unfortunate patient. This, however, did not occur, a sone side remained palsied: the convulsions,*

* Cases No. 9, 10, and 21, exemplify the baneful effect of tension in the direction of the length of the limb, and show us how carefully we should guard against it. We observe the same circumstance in incipient necrossis, and in all inflammations of the bones of the limbs, as the muscles are then permanently contracted, and are restored to their natural state only when the bones are relieved from disease. Much has here been said of the injury resulting from the rough bones irritating the soft parts, but, do not rough ends of bone produce similar injury when so placed as to unduly press upon each other? It will be observed that the symptoms in all our cases have become mild, as soon as the bone has been shortened.

See Cases Nos. 1, 3 ,4, 7, 8, 10, 11, 12, 13, 14, 17, 18, 20, 23.

however, ceased, in proportion as the fracture healed, which was in about two months, or two and a half. No perceptible exfoliation occurred, although, as I have said, the bones were protruded through the flesh, and shot by each other more than an inch.—M. de La Motte. Vol. 2, page 581.

CASE XXII.

John Nestor, doctor of physick, Richard Hubert, and I, went togcther to visit a patient at the place of the Frier Minorites. Wherefore, intending to pass over the Seine within sight of the place, I endeavoured to make my horse take boat, and therefore switched him over the buttocks. The jade, madded herewith, so strucke at me with his heels, that he brake both the bones of my left legge, some four fingers breadth above my ankle. Then I, fearing some worse mischiefe, and lest the jade should double his blow, flew back, and as I fled backe, the broken bones flew insunder; and breaking through the flesh, stocking, and boote, shewed themselves, whereby I felt as much paine as it is creditable a man was able to endure. Wherefore I was presently carried into the boate, that I might be carried to the other side of the water to be dressed, but the stirring of the boate as they rowed, almost killed me with bitternesse of paine, for that the sharpe fragments of the bones were rubbed against the flesh, which lay next them. Being ferried over, as I was conveyed into the next houses, my pain was much encreased, whilst lifted by the hands of divers persons some while up, another downe, sometimes to the left side, otherwhiles to the right, with my whole bodie and all the parts thereof. When at the length, I was layd upon a bed, I was somewhat freed from the bitternesse of my paine, and had time to wipe off the sweat, which ranne downe over all my bodie. Then was I dressed with such a medicine as the time and place would afford; we composed it of the white of an egge, wheat floure, soote of a chimney, and melted butter. For the rest, I intreated Richard Hubert that he would handle

me as if he knew mee not, neither that moved for love of me, he should remit any of the severitie of art, but chiefly that he should stretch my foot straight out and if the wound were not sufficiently wide that hee would enlarge it with his incision knife, that so hee might the more easily set the broken bones in their due place; that he would with his fingers, (whose judgment is farre more certaine than the best made instruments) search whether the splinters which were in the wound were quite severed from the bone, and therefore to be taken forth; that he would with his hand presse forth the blood and the clods of blood, which were in a great quantitie concrete at the mouth of the wound. That he would bind up and place my legge in that site and manner as he thought best.

* * * * * *

In the beginning of my disease, I used so spare a diet that for nine daies, I ate nothing each day, but twelve stewed prunes, and six morsels of bread, and drank a Paris pinte of sugred water. * * I was purged when need required with a bole of *Cassia* with rubarbe. I also used suppositories of Castle soape to make me goe to stoole, for, if at any time I wanted due evacuation, a preternaturall heat presently seized upon my kidneyes.—*Ambrose Paré, Treatment of his own Case, page* 582.

CASE XXIII.

Joannis Sculteti Observatio LXIV.

De majori fosili contriti cruris, serrâ, tres digitos decurtato, illaeso incessu, curato.

Gulielmus Bernardi, annorum quadraginta quinque, cerevisiae bajŭlus in aggere Harlemensi, portaturus vas in cellam, ex cadi casu, crus in plura quam viginti fragmenta contritum reportat. Ad quem decimâ quintâ Aprilis 1650 vocatus, deplorandam aegrotantis deprehendo conditionem. Collectis animi viribus operationi me accingens, attritum crus per famulos apprehendi curo. Et ista fosilis majoris portione, quae ad minimum trium digitorum latitu-

dine eminebat foras, serrâ ablatâ, residuum convenientibus spleniis, fasciis, et medicamentis, probe devinctum tam feliciter restituimus, ut hoc pede, sine claudicatione in hodiernum utitur diem.— *Opera Joannis Sculteti Renovata et Aucta Amstelodami Ao* 1672.

CASE A.

On the ninth of August, 1816, an insurrection occurred at the Massachusetts State Prison, in which thirteen convicts were severely wounded, principally by firearms. Of this number, Elijah Sloane, aged twenty-four years, received a musket ball, in the upper and outer part of the leg, just below the knee, which passed obliquely downward, through the limb, causing a fracture of both the tibia and fibula.

The prison records state, that Sloane died on the morning of the twenty-fourth day, of the same month; and that '*symptoms of inflammation and irritation,* which occurred immediately after the wound, made amputation inexpedient.*'

In an examination after death, several pieces of bone were found driven deep into the muscular, nervous, and vascular tissues of the limb; in consequence of which injury, these tissues had become so inflamed and swollen, as to roll out from under the unyielding fascia, when divided longitudinally, and to present the appearance of a blackish, and half disorganized mass of flesh, es-

* It should be here observed, that this wound was inflicted at 6 o'clock, P. M., and that two of the patient's comrades received wounds which were regarded, at the time, as more dangerous, and requiring more imperatively the care of the surgeon of the prison, (the late Dr. Josiah Bartlett, well remembered by the older Fellows of this Society, as an able man in his profession;) so that Sloane was not attended to, until some hours after he received the wound.

Of the convicts just alluded to, one was shot through the right side of the chest, the ball entering near the spine, and emerging near the edge of the sternum; the other had a ball pass through the root of his neck, from immediately above the superior angle of the scapula, to a point an inch above, and just outside of the clavicular attachment of the sterno cleido mastoid muscle. This wound was attended with profuse arterial hemorrhage. Both these men, however, recovered.

W. J. W.

caping, as it were, from the embrace of a powerful press. A perfect solution was thus made manifest of the severe symptoms, and fatal tendency of this case, even from its outset.

CASE B.

Some years since, a young man of feeble constitution, named Bruce, received a wound in his left thigh, under the following circumstances:—He was passing through Park street, Boston, whilst an infantry company were firing, on parade, near the great elm tree on the common. He fell, at the moment, and was unable to rise again.

On seeing him, soon after, I found that a ball had passed through the integuments of the thigh, a hand's breadth above the patella. By bending the leg forcibly upon the thigh, the course of the ball was found to be, into the knee joint. There was no hemorrhage, externally, nor was there great pain at the time.

Neither the patient, nor those about him, could be made to realize the great danger of the case. I, however, advised immediate amputation, as the only means of preserving the patient's life. My advice was disregarded, and the opinions of other medical men requested in consultation.

In about six hours, symptoms of the most threatening kind were ushered in, by a chill, and in four hours more, at the patient's most earnest entreaty, I amputated his thigh, with but little expectation of benefit. The operation was completed in little more than a minute. The skin came into nice and even contact, over the divided femur, and the patient was speedily placed in bed, with the loss of but little blood. He spoke incoherently, before being removed from the table. The bad symptoms continued and became more and more aggravated, for about fourteen hours after the amputation, when he expired.

On examining the limb, the ball was found to have split off one of the condyles of the femur, and produced great inflammation and effusion of blood in the joint. W. J. W.

CASE C.

About eighteen years since, a son of Capt. Treadwell, of Ipswich, county of Essex, while splitting wood, near his father's door, received in the calf of his leg, near the ham, a charge of pigeon shot, from a gun in the hands of his brother, at a distance of about forty feet.

On my first seeing the patient, not far from twelve hours after the accident, the whole limb, from the knee downward, was swollen, elastic, and lacking its natural warmth and feeling. No pulsation could be felt in the arteries about the ankle and foot. The capillary circulation was peculiarly languid; the vessels turgid and containing blood of an uncommon, dark hue. The knee was tender to the touch, and motion of the joint gave great pain. Immediate amputation was advised and practiced. Delirium commenced while the patient was being placed on the table to undergo the operation. On cutting through the flesh, it was found, that the common sheath of the vessels was already gorged with lymph, and this appeared to be fast extending upward. The operation was quickly done, the arteries secured, and the dressings applied; after which he was placed in bed, and carefully nursed. The delirium and other bad symptoms gradually subsided,* and he recovered in due time. On dissecting the parts, the popliteal nerves and vessels were found to be perfectly riddled by the shot having passed through them. Seven shot were found to have penetrated the knee-joint and remained loose therein.

In this case, I doubt not that gangrene had already commenced, and except for the amputation, that death must have ensued in a few hours. W. J. W.

* Les effets de la commotion, loin de s'aggraver, diminuent et disparaissen insensiblement après l'operation.—*Baron Larrey. Vol.* 2, *page* 484.

CASE D.

Mr. Edward Cutter of Somerville, forty years of age, and of temperate habits, was kicked by a horse, three inches below the knee. One of the calkins of the horse-shoe had here penetrated the tibia, and produced a very oblique fracture. At this spot, and here only, were the fascia and soft parts much injured. Two splinters, each more than a couple of inches long, of the compact shell of the tibia were removed, together with some of its cancellated structure. The fibula was sound and entire. The wound was dressed with the mildest applications, no attempt ever being made to approximate its lips. Neither splints, bandages, nor apparatus of any sort were used, at any time. An elevated and easy posture for the leg, rest, spare diet, and a moderate purge, daily, for the first week, constituted the whole treatment. Under this simple management, the wound cicatrized in eighteen days, with only slight superficial suppuration. Nothing untoward occurred to retard the cure, which was completed within forty days.

W. J. W.

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CASE E.

March 7, 1840, Edward L. Heath, a convict in the Massachusetts State's Prison, about twenty-eight years of age, and of sound constitution, suffered a compound, not comminuted, fracture of the right leg, in consequence of a block of granite falling upon it. The upper fragment of the tibia protruded through the skin, about five inches below the knee. There appeared to be much laceration of the fascia, as evinced by the looseness of the lower fragment of the tibia, and the presence of a large cavity, reaching nearly to the inner ankle, filled with venous blood. The bones were easily replaced in apposition. A free counter opening was made near the inner ankle, through which blood and serum found a ready exit, as soon as they were effused, into the wound. The limb was laid on its heel, elevated about twelve inches above the body.

The foot and leg were kept in their relative positions and supported by splints and dressings as described in the case of William Tyler. Neither suppuration nor other accident occurred to retard the progress of his cure. On the third day of April, he was able to raise his leg from the bed. On the nineteenth day of the same month, he attended chapel service, and was discharged, able to labor the next day, having been forty days in the hospital.

W. J. W.

CASE F.

Not far from fifteen years ago, I saw, in consultation with the late Dr. Edward Frost, Mr. Jonathan Bullard, of Wayland, who, three months before my visit, had broken his leg. The fracture was compound, a sharp point of the anterior edge of the tibia having slightly perforated the skin. The bones, however, were not shattered, and the soft parts were not contused nor extensively lacerated. The bones were replaced with ease; and the lips of the wound were kept in contact. After a while, suppuration took place, and the matter, not having a dependent outlet, and being pent up by the fascia, burrowed and penetrated deep, into and among the different textures of the limb. This state of things was followed by loss of appetite, thirst, emaciation, sweatings, and diarrhœa. There were also well marked incipient sloughs upon the shoulders, heel, and sacrum. The question proposed for my decision was, whether amputation could save the life of the patient thus debilitated. I advised that the limb should not be removed; but that a large and free counter-opening should be made by the side of the fibula, near the ankle, to allow exit to the pent up matter. Accordingly, I made the proposed opening, cutting deeply and with great success, as about two pounds of pus were discharged at once, and an outlet obtained, through which the matter, that formed subsequently, had a ready means of escape.

All the bad symptoms forthwith subsided, the appetite returned, and restoration to health was rapid. W. J. W.

CASE G.

By command of the King, I went to visit Charles Phillip of Croy, Lord of Auret, who had long suffered from the effect of a compound fracture of the femur. 'The thigh bone was broken long wayes and side wayes, with many splinters of bone, whereof some were plucked out, and others remained sticking fast in. He besides also, had an ulcer in his groine, which reached to the midst of his thigh, and many other sinuous ulcers about his knee. All the muscles of his thigh and legge were swollen with a flegmaticke, cold and flatulent humor, so that almost all the native heate of those parts seemed extinct. All which things being considered, I had scarce any hope to recover him, so that I repented my coming thither. Yet, at length, putting some confidence in his strength and prime of youth, I began to have better hopes. *Therefore, with his good liking, first of all, I made two incisions, so to let forth the matter, which, lying about the bone, did humect the substance of the muscles. This had happy successe, and drew out a great quantity of matter.*' * * * * *

'To conclude, his fever and paines being assuaged, his appetite restored by feeding plentifully upon good meates, according to his strength, he in a short time became more lusty; and lastly, by the singular mercy of God, recovered his health perfectly, but that he could not very well bend his knee.'—*Ambrose Paré. Page* 431.

CASE H.

A mason fell, from a scaffold, a distance of more than thirty feet, and suffered a compound fracture of the thigh, in consequence of a block of stone falling upon it the same distance. Although the great injury to the soft parts, as well as the extensive splintering of the bone, seemed to indicate amputation, yet I determined to try to save the limb. With this view, I placed the patient close

upon the edge of a bed, made smooth and even, so as to facilitate the dressing. I then folded a square piece of linen in form of a cravat, placed it round the thigh close to the groin, tied the corners together, and gave it in charge to an assistant, to serve as a counter extending power. I then directed extension to be made, by a second assistant, grasping, with both hands, the thigh just above the knee, while a third aided him by drawing down the foot. I executed this manœuvre with the view of straightening the limb, and of placing its parts so that I might, with accuracy, make my incisions of dilatation, and that the patient might be supported and kept from injurious efforts, rather than for the purpose of extension. I next thrust my finger into the wound, using it as a directory, and thus divided all the parts which had suffered laceration, both above and below. I sought for all membranous parts, and divided them. In a particular manner, I sought out and divided the fascia lata, both transversely and longitudinally, and in a number of places; and I aver, that this is the only way to prevent such inflammation, and swelling of the muscles, as would otherwise produce such tension of the whole limb, as to lead to strangulation, or to the most fatal collections of matter.

Having finished my dilatations, covered the ends of the bones with lint and strips of linen, for the purpose of protecting the soft parts from the irritation of any of their sharp points, and reduced the bones, so covered, to their proper places, I laid the limb in a proper situation, intending so to keep them, until any exfoliations which might occur, should come away. At the third dressing, I removed all the lint and strips of linen which I had placed over and about the ends of the bones, and I found they had much assisted in keeping the parts in apposition. In lieu of the strips of linen, I now substituted large dossils of lint, dipped in brandy. The external dressings were smeared with common digestive, mixed with brandy; and these were covered and supported by suitable compresses and bandages. * * * *

—*J. L. Petit.* *Page* 172.

CASE J.

Here we can succeed only by proper incisions and dilatations; by the use of such means we may ensure success, by preventing the formidable symptoms of swelling, suppuration, and burrowing abscesses, which, otherwise, would divide the parts in sunder, and require many counter openings. All such incisions should be made with great judgment and care, and should penetrate quite to the sound parts of the shattered bone. In no other way can we decide what fragments may reunite with the body of the bone, and what should be considered as foreign bodies, dissected from their adhesions, and removed. Between the naked ends of the bone, and the soft parts, we should place dossils of lint, and so continue to dress the wound, until all swelling has subsided, and all loose fragments or shivers of bone have been discharged. Almost all the cases which I have witnessed, where deep incisions were neglected, have ended in gangrene and death; while those patients, in whose cases, free and judicious dilatations have been practiced, have escaped the direful and dangerous symptoms above alluded to, and obtained an easy and happy cure.—*Martinière. Mémoires de l'Académie. Vol* 11, *page* 17.

CASE K.

* * * * I took great pains the first two months of treatment, to observe if the broken leg were of the same length with the other, in order to avoid the blunder of the two old surgeons, to whose care the duchess of Ventadour had committed her coachman; this man's leg was broken near the middle, with a large wound. I was called in, three weeks after the accident. The wound was then granulating well, and the patient in good health, but the limb was full four inches shorter than the sound one, in consequence of the blindness of these surgeons; they had placed a board at the foot of the bed, against which his foot

rested, in order that he might not slip down in his bed; the effect of which was, that the ends of the tibia overlapped each other to the extent which I have mentioned, without these surgeons perceiving it in the slightest degree; although it struck me at once, even before the bandage was removed; I reduced it, however, gradually in the course of the day, to the same length with the other. The limb recovered perfectly, without any inconvenience, from the second reduction, from the great care which I took in placing the bones perfectly even.—*La Motte, vol.* 2, *page* 374.

CASE L.

In order to reach and extract, without violence, a ball deeply buried in the thigh or nates of a stout man, extensive and frightful incisions must be made, and surgery repudiates that man who fears or hesitates to make them, whenever there be occasion, and the operation is practicable, without wounding the trunks of the large nerves and blood vessels. Such incisions should be made in every direction through the fascia lata, as well as through the sheaths of the muscles, and no sinus in the course of the wound should be left unopened. In the leg and fore arm, we should not spare the aponeuroses, which having furnished an envelope to the whole body of muscles, subdivide themselves into sheaths embracing each muscle by itself. Foreign bodies are often found impacted within their embrace, and it is as necessary to divide these membranous expansions for the prevention of mischief as for the easy extraction of foreign bodies. All such incisions should penetrate quite to the sound ends of the fractured bone, so as to afford ample room for the removal of loose portions of bone or other foreign bodies.—*Baron Percy, Manuel du Chirurgien D'Armée. Page* 149 *and* 159.